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"DRIVE BY THE SQUARE"
"CENTER BY THE SHANK"

Taps, Drills, Reamers, End Mills, Woodruff Keyway Cutters, Etc.

CONSTRUCTION — **"Scully-Jones"** Chucks are ***hardened, split, taper shank collets*** provided with broached holes for driving straight shank tools; made in one piece, have no parts to get out of order and require no wrenches or special tools to use.

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Tools run true and cut uniformly, therefore, ***last longer.***

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STOCK SIZES of **"Scully-Jones"** Chucks ranging from No. 0 to No. 5 Morse Tapers drive all size straight shank tools up to 1½" diameter and are sent on approval.

OUR NEW SMALL TOOL CATALOG No. 36 describing a greater variety of **"Scully-Jones"** Production Tools is now ready. Send for your copy at once.

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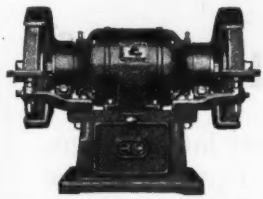
For Operation From Lamp Socket on Alternating Current

— eliminate the disadvantages of the old-fashioned split phase grinder



Bench Grinders with Repulsion Induction Motors made in ¼, ½, 1 and 2 H. P. sizes.

Single Phase alternating current machines are equipped with Improved Commutating Type Repulsion Induction Motors, which unlike the old Split Phase Motor have no dragging centrifugal switch. They will start and pick up speed instantly under any load within twice their rated capacity. Starting current under all conditions is unusually low, being less than one-third the current consumption of Split Phase Motors. Low voltage so often encountered, due to line drop and other existing conditions which cannot always be overcome, is the cause of much trouble in Split Phase Motors.

Low voltage has no objectionable effect on these new Hisey Repulsion Induction Grinders.

Floor Stand Grinders with Repulsion Induction Motors made in ¼, ½, 1, 2 and 3 H. P. sizes.

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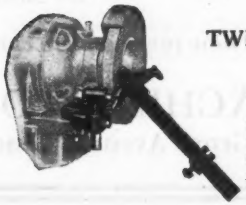

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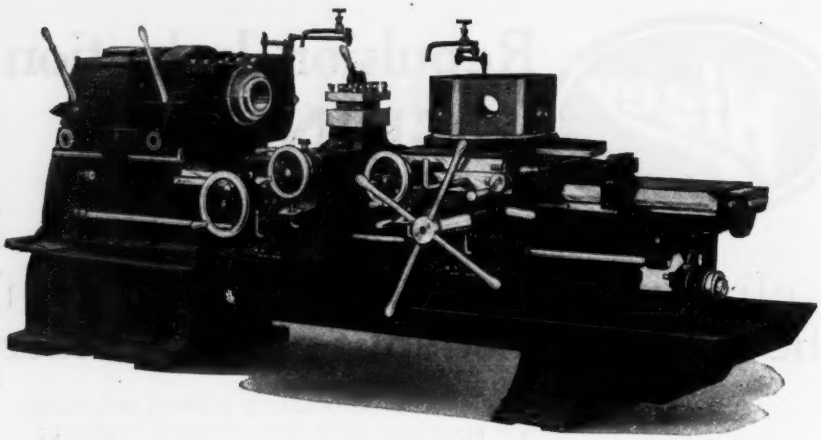

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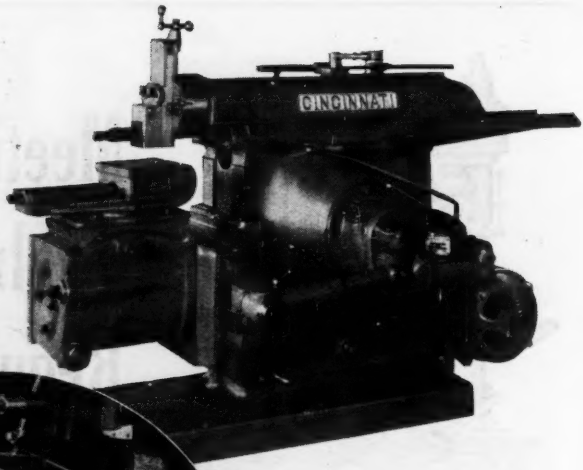

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A revolving table with a tilting top without hinges, jacks or table support.

A complete bulletin describes this shaper in detail. Write for it.

The Cincinnati Shaper Co., Cincinnati, Ohio

MODERN
Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES

Published monthly at 128 Opera Place, Cincinnati, Ohio

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Vol. I JULY, 1928 No. 2

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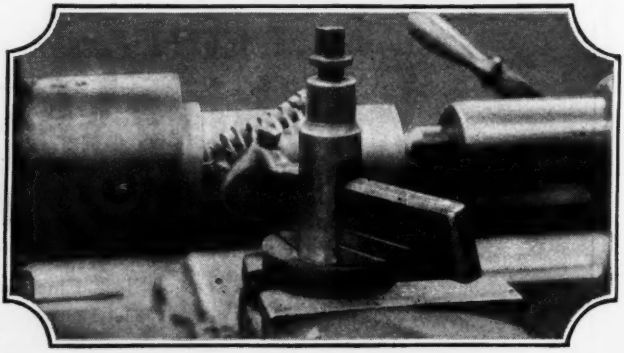

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Straight Shank Cut-off Tool

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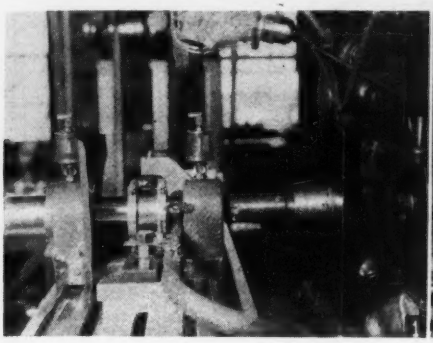
Pipe Cutters
Hinge Vises
Chain Vises

Operations In a Contract Shop

By PHILIP WINTER

THE modern trend toward the use of machinery for performing all kinds of labor operations is being reflected in the demand for experimental, jobbing, and tool-making service. There are many large plants throughout the country that have developed nice businesses through their ability to do well any job that came their way. Such a plant is that of the Steel Products Engineering Company, Springfield, Ohio.



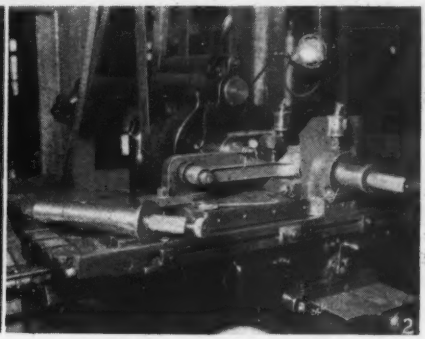


Fig. 1—Boring connecting rods for Liberty motors. Fig. 2—The rod in position for boring. Note the locating bar.

This firm has established a national reputation for having both the equipment and the engineering ability to handle anything from ordinary manufacturing to the finest kind of tool and die work. Such a business cannot be developed except by foresight; one cannot wait until he has the work and then buy the necessary equipment; the man who is in search of mechanical service wants to see wheels turning before he hands out his job.

Those who have come to this plant in search of service have found a complete assortment of metal-working machinery — lathes, screw machines, milling machines, boring mills, drill presses, grinders, and one of the finest-euipped toolrooms in the country. The result is that this shop is now handling a number of experimental jobs, making dies and fixtures for some of the largest automobile plants, rebuilding a quantity of Liberty motors for the U. S. Government, building special machinery for airplane manufacturers, and manufacturing a line of shapers. The business has grown to such proportions that more space has become necessary and a new building is now under construction which will double the present floor-space.

In order to save time and produce the best possible work on the repairing of the Liberty motors, a number of tools and fixtures have been developed. One of the fixtures, shown in Fig. 1, is used for boring the connecting rods. The operation is performed on a milling machine, which

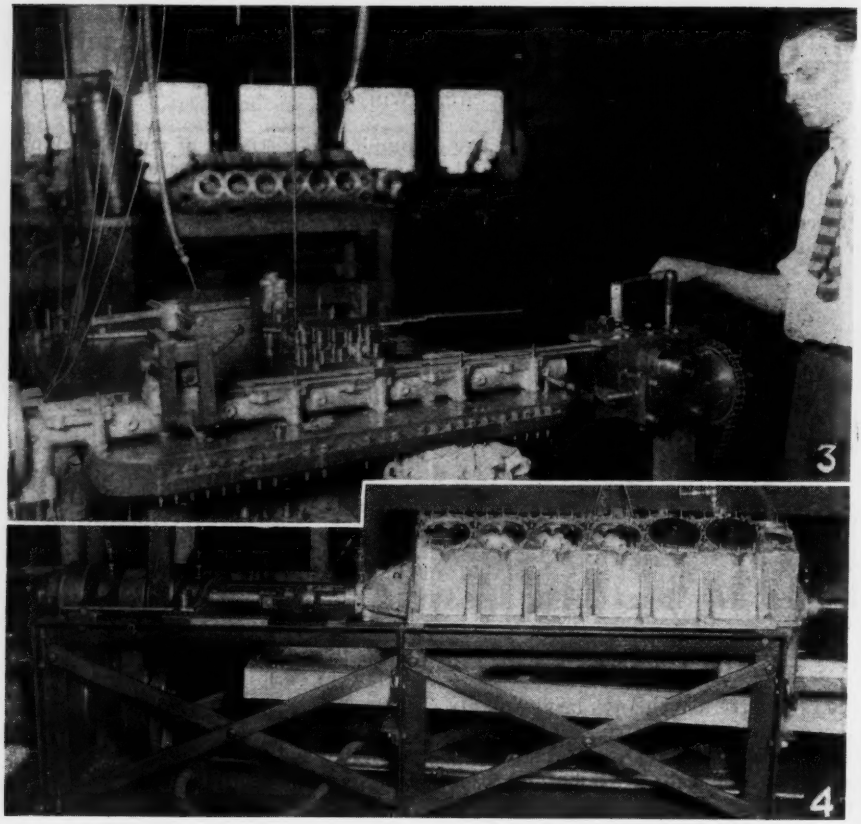
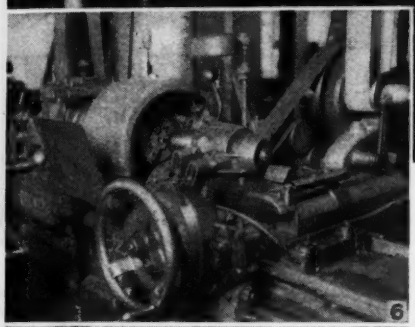


Fig. 3—Broaching rocker-shaft holes in a Liberty motor camshaft housing.
Fig. 4—Boring out the main bearings.

provides a base upon which to locate the job, and power for the tool. The tool, however, is a single-point cutter, held in a bar that is part of the fixture.

The fixture is an iron casting consisting mainly of two bearing supports, each of which is bored out and bushed with a bronze bushing. The boring bar is a running fit in these bushings, and is driven by a driving unit consisting of a sleeve that is pinned to a taper shank which fits into the machine-spindle. The end of the bar fits into a bayonet lock in the end of the sleeve. Two sight oilers keep the bushings well oiled. To locate, the connecting rod is put into the fixture, then a locating bar, shown at A, Fig. 2, is put through the bearings and rod. By turning a screw in the end of the bar, two pins in opposite sides of the bar are fed outward, and as the bar is always inserted so that the pins will be vertical, the pins locate the rod so that it perfectly central vertically. The pin that holds the small end of the rod locates it horizontally. The rod is clamped in this position and the locating bar is



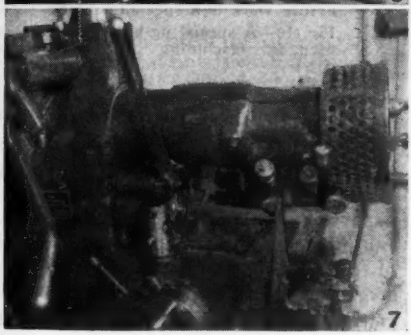
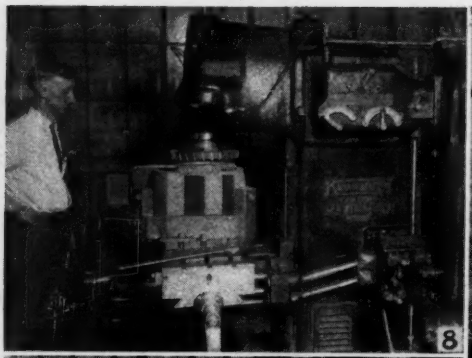


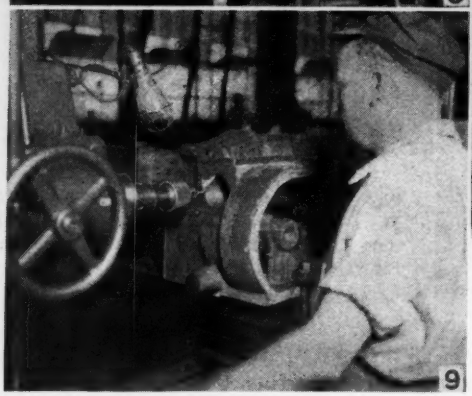
Fig. 5—View of the gear-cutting department. Fig. 6—Grinding holes in gears. This machine stops automatically when the hole is finished. Fig. 7—Another type of internal grinder for production work.

exchanged for the boring bar. In operation, the tool is sprayed with coal-oil, which is pumped through a copper tube which forms a loop about the bar and in which a number of small holes have been drilled.

The repair of Liberty motor camshaft housings and caps, which are usually found worn and scored, presented a problem which was solved by the use of a broach. The caps are removed from the housings, each is chucked in a lathe and .010 inch is faced off, then the caps are bolted to the housings again and broached for the levers. The broaches are short, each having five teeth, and four broaches are used on each hole. Two bearings are broached at a time.

In order to perform the broaching operation efficiently, the machine shown in Fig. 3 was built. The machine consists mainly of an electric motor which is connected by a chain to a sprocket on a shaft that also carries a worm. The worm drives a worm-wheel on a shaft that carries a gear which meshes with a rack on each of the shafts that push the broaches. The housing is bolted to an iron plate in front of the machine, the housing cap is clamped in posi-





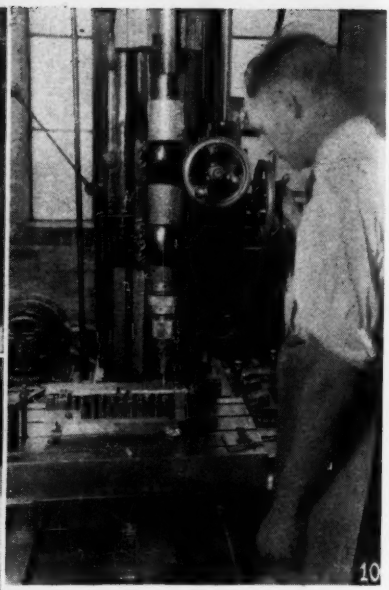


Fig. 8—Such equipment as this returns a profit on every job. Fig. 9—Jig and fixture work is a specialty in this shop. Fig. 10—A special jig-boring machine is used for machining small, fine work.

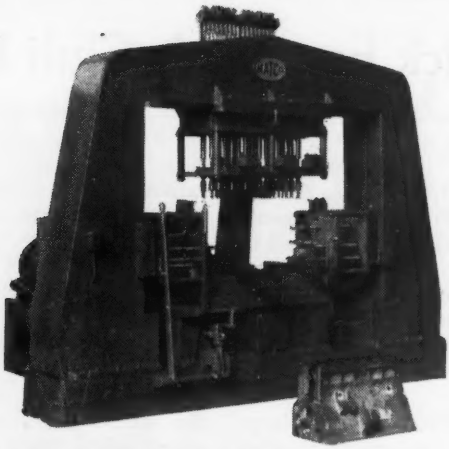
tion by a special equalizing clamp, and the operation proceeds.

The main bearings in the Liberty crankcases are bored with the machine shown in Fig. 4. A single-point cutter is used and one bearing is bored at a time, power being supplied by a belt from the line-shaft. The tool is fed through the work by a unique device consisting of a sleeve through which the cutter-bar is threaded. A train of pulleys is arranged so that, although the sleeve and shaft revolve together, the ratio of the sleeve to the shaft is about 5 to 6 and thus the bar is slowly but evenly fed through. With this fine feed and a bath of coal-oil, which is constantly sprayed on the tool, a fine finish is obtained.

Orders for gears have assumed such proportions that a number of new gear-cutters have been recently purchased and a special gear-cutting department has been created. This department, shown in Fig. 5, is now equipped to cut practically any kind of gear desired, excepting the very large ones, for which special machinery is required. Testing fixtures of the latest design have been installed in the department and accuracy has been made the first law of this department.

A gear in process of having the hole ground to size is shown in Fig. 6, in a Heald "Size-Matic" internal grinding machine. This machine is designed to eliminate the lost time of gauging the hole, and is so constructed that

(*Continued on page* 59)



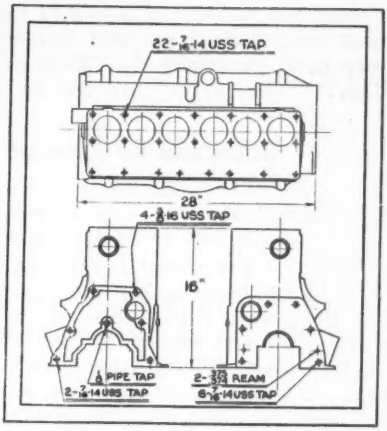
60 CYLINDER BLOCKS TAPPED PER HOUR

The above illustration shows a NATCO 3-Way Lead Screw Tapper built for tapping the two ends and top of a Cylinder Block.

Machine is built of one vertical and two horizontal heads with individual lead screws to each individual tap.

This machine is semi-automatic in operation, going thru one complete cycle at each pull of the starting lever.

The numbers and sizes of holes tapped are shown in the line drawing at right,



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May we give you a proposition on your "holes?"

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA, U. S. A.

Fosdick Foremen's Club Rules

SINCE the June issue of MODERN MACHINE SHOP was mailed, a number of requests have come in for more information on the subject of the Fosdick Foremen's Club, which was discussed in detail in that issue. Many letters have been received from plant executives who are keenly interested in the manner in which the business of the club is handled, and in the results that have been obtained.

The superintendent of one large plant wrote in to tell us that, after reading about the purpose and methods adopted by the Fosdick Club, his foremen immediately formed a similar club, to be operated along the same lines. The master mechanic of a plant in North Carolina said **"I have read your June issue and found it very good, especially the "Foremen's Club'."** The works manager of an Ohio plant said **"I liked your article on the 'Foremen's Club That Produces'. Too many foremen's organizations are a waste of time, due to the lack of a definite objective."** The general foreman of a Pennsylvania shop tells us **"We have organized a foremen's club along the lines of the club described in your June issue. Can you give us a copy of the rules and by-laws spoken of in the article?"**

These excerpts are from a few of the letters that came in, several of which asked if we could supply them with copies of the rules and by-laws used by the Fosdick Club to govern the conduct of its meetings. As these rules would undoubtedly be of use to other executive's organizations, we have obtained permission from the Fosdick Foremen's Club to publish the complete set of rules, which are as follows:

Rules and By-Laws of the Fosdick Foremen's Club

1. The assembly is to be known as the Foremen's Club of the Fosdick Machine Tool Company.

2. It will be designated hereafter as The Club.

3. The object of The Club is research in mechanical work.

4. The members of The Club shall consist of the head men of the several departments of The Fosdick Machine Tool Company.

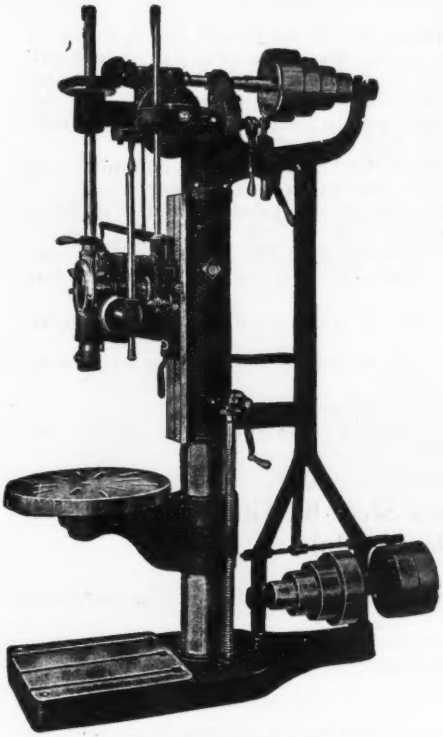
5. The officers of The Club shall consist of a president and a secretary, whose terms of office shall be of six months' duration.

6. The president and secretary shall be elected by a majority vote of The Club from nominees selected by a committee appointed by the president.

7. A quorum will consist of seven members of The Club, including the president and secretary.

8. The meetings will be held on the first Wednesday of each month at the plant of the Fosdick Machine Tool Company, beginning at 7:30 p. m. at the call of the president, and will continue until adjourned by motion.

.9 The duties of the president will be to preside at all meetings, to appoint all committees, to appoint a substitute in case he is unable to serve at the next coming meeting, to call the order of business



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UPRIGHT
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15, 20, 22½, 25-inch swing.

With Sliding Head—
22, 26, 28, 34, 42, 50-inch swing.

Gang Drills—
20 to 26-inch swing.

Barnes Upright Drills are made in a range of sizes from the 50-inch swing, required in the railroad shop, to the 15 and 20-inch sizes used in the small machine repair shop and garage service.

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before The Club, to rule on motions made when desired, to appoint a substitute secretary in case of the secretary's absence, and to vote on motion in case of a tie vote.

10. The duties of the secretary will be to record the minutes of the meetings, to read or submit at the direction of the president the minutes of the previous meeting, to record the names of those who are appointed on committes and notify the appointees, to be the custodian of all records of the club, and to vote on any motions made if he so desires.

11. The president shall not appoint himself as a committee of one nor to serve on any committee, but can act as advisor.

12. These rules and by-laws can be amended or added to by a two-thirds vote of the members.

13. The president can appoint council of one person who is not a member of the club, who shal lhave the privilege of discussion but cannot vote.

14. The secretary shall not act on any committee, but can serve as an advisor.

15. A regular meeting can only be postponed by a majority vote recorded by the secretary.

16. The secretary shall date and sign the minutes.

17. The Club shall be governed by parliamentary law as set forth in these rules and by-laws.

The Order of Business Shall Be Governed By the Following Rules:

1. Roll call.
2. The reading of the minutes of the previous meeting and their approval or rejection.
3. Report of standing committees.
4. Report of selected committee.
5. Unfinished business.
6. New business.
7. No business can be taken up out of its regular order without a suspension of the rules, or when regular business has been laid on the table by motion.
8. The rules can only be suspended by a two-thirds vote of the members present.
9. A motion can only be made by a member after he has obtained the floor by addressing the president and has been recognized by name.
10. A motion can only be seconded by a member after he has obtained the floor by addressing the president and has been recognized by name.
11. When a motion has been properly made and recorded, the president shall state the motion, after which discussion shall be in order.
12. After a motion has been stated by the president, it shall not be withdrawn without the consent of the club.
13. Any member shall have the privilege of making a point of order during debate.
14. A request can be made through the president that the speaker yield during debate and the speaker shall yield only with his consent.

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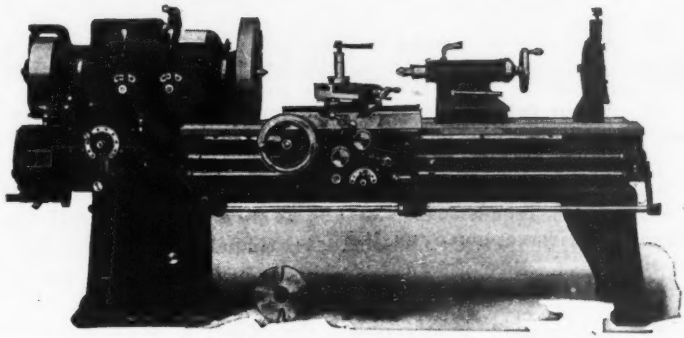

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The Mechanical Engineer of one of our large railroads made the statement recently, "The **Boye & Emmes Coneless Lathe** is the best lathe we have on our system."

Complete Literature gladly sent on request. It will pay you to

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15. No member shall be allowed to speak more than once on the same subject until all who desire to speak have done so.

16. An order limiting debate or closing debate may be adopted, or the speaker may signify when through speaking.

17. While in discussion the speaker shall confine himself to the question, and shall not include personalities.

18. A member who has made a motion can vote against his motion but shall not speak against it.

19. The floor may be obtained by a member through the following procedure:

1. A motion by which the subject is brought before the body.
2. A motion to amend or substitute a motion.
3. A motion to adjourn.
4. A motion to suspend the rules or to lay a motion on the table.

20. A motion to amend or substitute a motion must have the consent of the maker of the motion and the motion to amend or substitute shall be made through the president.

21. When debate has ended, the president shall ask "Are you ready for the question?"

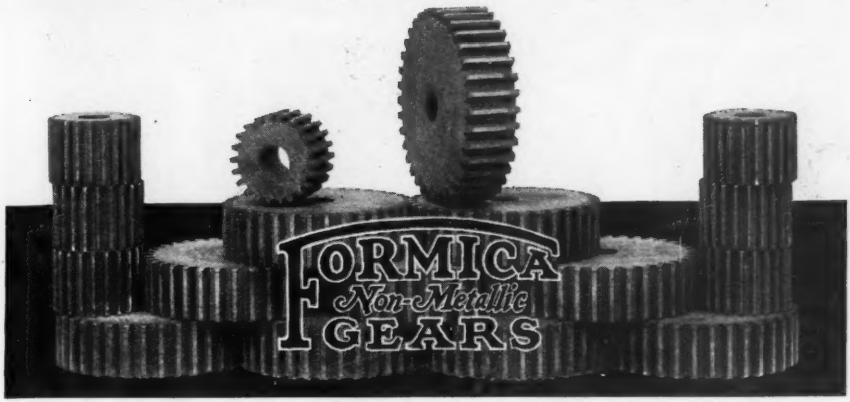
The comments that have been received, along with requests for further information, have given us the satisfaction that comes with the knowledge of having performed a useful service. Every article published in MODERN MACHINE SHOP will be selected with the idea that it must contain practical, useful information, and we will always be glad to receive suggestions, requests for additional information, and criticisms. We want our readers to consider this magazine a clearing-house for ideas; a good idea is the most useful of tools and is one tool that a man can pass on and still have it.

More Than 21,000 Copies In June!

TO THE advertisers who patronized the June issue of MODERN MACHINE SHOP we guaranteed a circulation of 20,000 copies. We have more than kept our word. The U. S. Postoffice receipts in our files will testify that we sent out, under our Official Permit, No. 1284, 20,698 copies. Added to that number are 363 copies that were mailed with 2-cent stamps attached. Through other sources, 156 copies were distributed, making a grand total of 21,217 copies placed in the hands of mechanical executives.

The July circulation will be more than

23,700 copies



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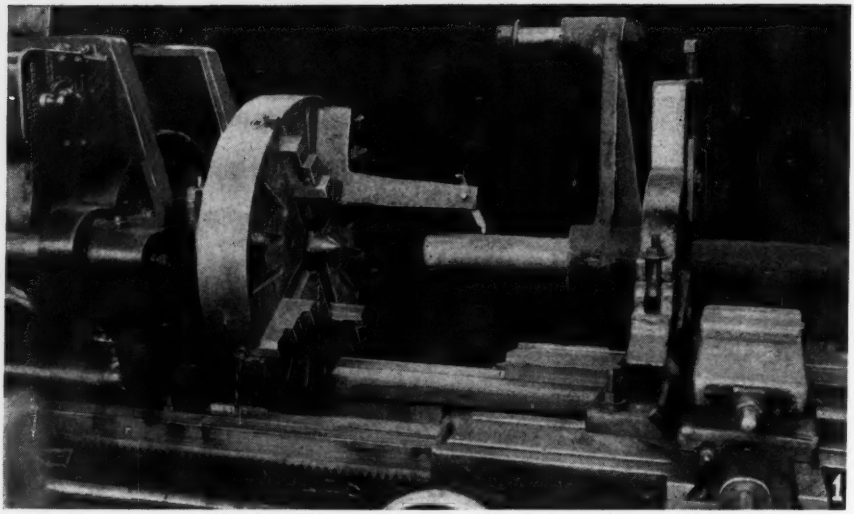


Time-Saving Tools In the Monon Shops

By M. J. Brush

At the shops of the C. I. & L. Railroad — otherwise known as the "Monon"—at Lafayette, Ind., a number of special tools and methods have been developed which should be of interest to the executives of other railway shops. One of these is a tool for turning the bearings on reverse shafts, shown in the illustration at the head of this article. The interesting feature of the tool is that, by using it as shown, a perfectly good job of turning the bearings can be done without the necessity of removing the arms.

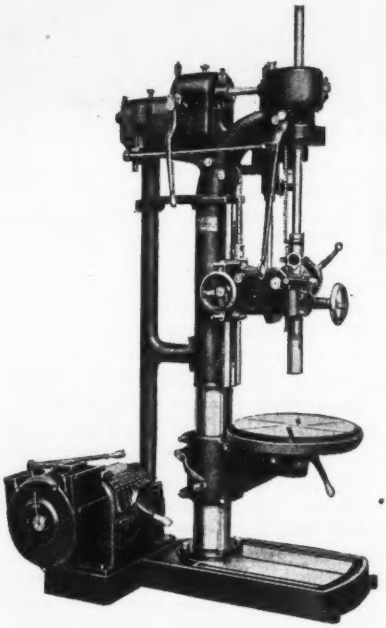
The tool consists of a forged steel holder which is drilled so that it can be bolted to the faceplate of a lathe, as shown, and a tool-bit which is inserted through a slot in the end of the holder. The shaft is first swung between the centers of the lathe, then two steady-rests are placed on the ways and the jaws are clamped tightly against the shaft near the ends. The center is then removed from the rear end of the shaft, the bolts that hold the steady-rests to the bed are loosened just enough so that the steady-rests will slide on the ways, and the rests, carrying the shaft, are pushed back far enough so that a full-length cut can be taken on the bearings. In turning the bearing, machine feed is provided by using the carriage to push the steady-rest nearest the tool. As the toolholder is longer than the bearing, the entire bearing can be turned without interference. A ¾-inch toolbit is used.

Another device that has saved a considerable amount of time is an outfit for milling teeth in reverse

The FOSDICK

21-INCH HEAVY-DUTY

UPRIGHT DRILL



Special Features:

The table can be raised, lowered, and clamped from either side of the machine, or swung around to clear the base for larger work.

The spindle is a high carbon hammered steel forging. Thrust taken on a ball bearing.

The quick return is friction type—acts instantly.

The hand wheel may be fed ahead of the power feed for starting large drills. After the power feed has been tripped, the hand feed can be continued without moving the dog.

Power feeds are all controlled by a single lever and can be shifted while drilling.

The friction reverse tapping mechanism is of the most powerful built. It is located on the high speed initial shaft.

These machines have been designed to meet the increasing demand for higher grade upright drilling and tapping machines than have heretofore been produced. The unusually wide range furnishes cutting speeds for drills from 3-16-inch carbon to 2½-inch high speed, in cast iron or steel, and for boring up to 5 inches diameter, all with but one speed of the pulley.

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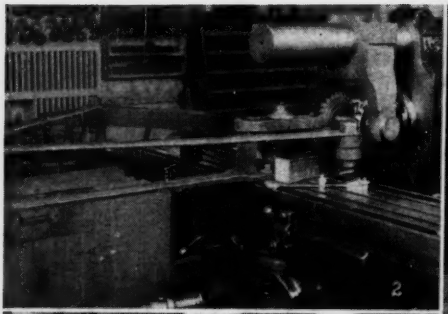


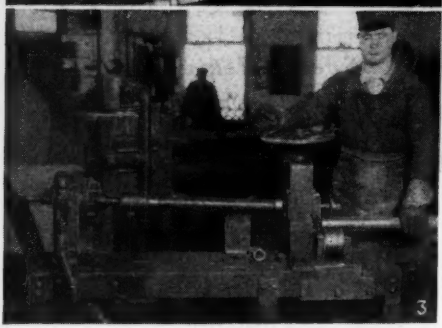


Fig. 2—Milling teeth in reverse lever quadrants. Fig. 3—The flue-cutters in this shop are operated by air-motors. Fig. 4—A home-made link grinding machine.

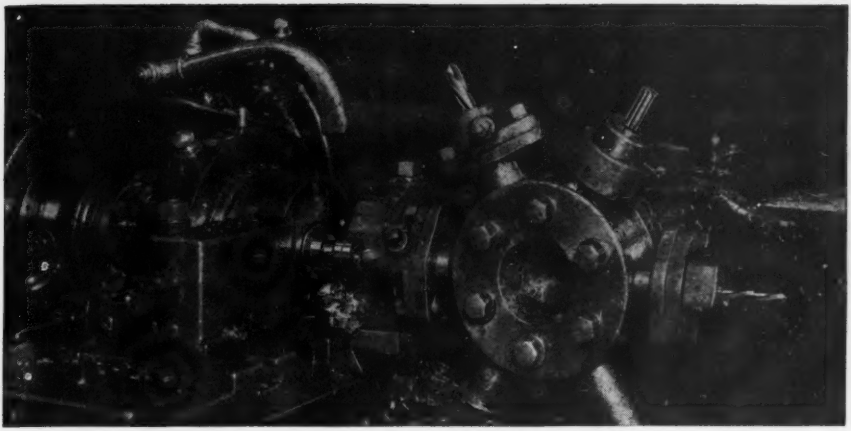
quadrants. The quadrants are shaped and the sides are ground flat on a disk grinder, after which they are laid out for the teeth. They are then bolted, in pairs, to the table of a milling machine as shown in Fig. 2. The table of the machine is locked in a central position, then a bar is bolted to the table at the center and parallel with the spindle. This bar serves as a support for two straps which are bolted to the ends of the quadrants, the opposite ends of both straps being bolted to the bar at a point which is the right distance from the cutter to produce the correct radius.

The cutter is located on a shaft that also carries a bevel gear, the corresponding gear being carried on a stub arbor in the machine-spindle. After a tooth has been milled, the clamp that holds the quadrants in position is loosened and they are swung into position for the next tooth.

Some time past it became necessary to move the flue-cutting machines, and as a temporary arrangement while waiting for the machines to be set up, an air-motor was rigged up for the job as shown in Fig. 3. This outfit has proved so much better than the original equipment that the other machines have been discarded entirely, and two of these air-motors are now in operation on this job.

The motor is bolted to a support at one end of the bench, a universal shaft attached to a spindle serving to drive the flue cutter, which is located on a shaft at the opposite end of the bench. The cutter-shaft bearings are located in a housing that can be raised and lowered by means of a feed-wheel, as shown. The air-motor provides all the power necessary and does away with the shafts and belting which were formerly required.

A home-made link-grinding machine



On this job, we cut drilling cost 76%

THE JOB

is a small brass pump base turned up from one inch rod stock in a No. 2 high speed automatic screw machine.

Outside machining is done with front and rear heads; drills and taps are mounted in turret heads. First boring operation consists of sinking a $^{29}/_{64}$-inch hole to a depth of $^{5}/_{16}$-inch. Work is run at 2,400 r. p. m. and feed is set at .006 inch per revolution. A $^{3}/_{8}$-inch counterbore is then run to a depth of $^{3}/_{4}$-inch ($^{11}/_{16}$-inch total), also at 2,400 r. p. m., with a feed of .011 inch per revolution.

CLE-FORGE HIGH SPEED DRILLS are, also, extensively used in this plant for other work, drilling through grey iron castings, and copper and brass rod stock, with that speed and satisfactory performance characteristic of these famous Drills.

IN the highly efficient plant of a midwestern lamp manufacturer, the problem was to reduce hole production cost, and speed up hole production.

On a small brass pump base, run through in 10,000-piece lots, careful tests showed that carbon steel drills averaged 780 holes per grind, 24 grinds per drill, and total drill life of 20,000 holes—with a direct drill cost of 36c per 10,000-piece lot. Regrinding frequently halted production—time loss totaled about 2 hours per lot.

CLE-FORGE HIGH SPEED DRILLS

TRADE MARK REG. U. S. PAT. OFF.

were then tried. They averaged 10,000 holes per grind (thus eliminating the time loss for regrinding), 19 grinds, and total drill life of 200,000 holes. Although *costing* this manufacturer, per drill, *more than twice as much* as the carbon drills, Cle-Forge showed a direct drill cost of only 8½¢ per 10,000-piece lot—demonstrating a net cost reduction of over 76%, while materially speeding up production! The net annual saving effected by Cle-Forge High Speed Drills on this job was $381.06—or about 2½ times more than the drills used actually cost!

If interested in reducing your drilling costs, let us send you this story in complete form. Ask for Digest No. 59.

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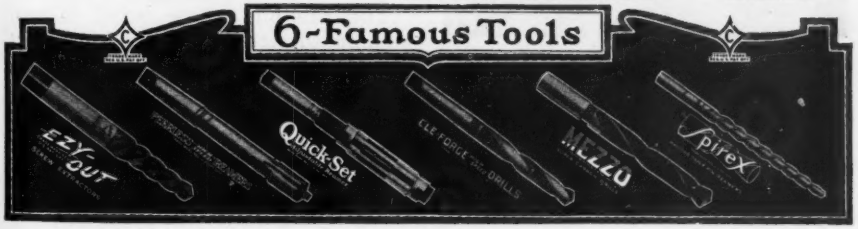
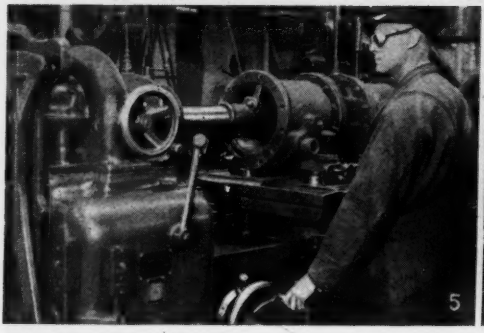




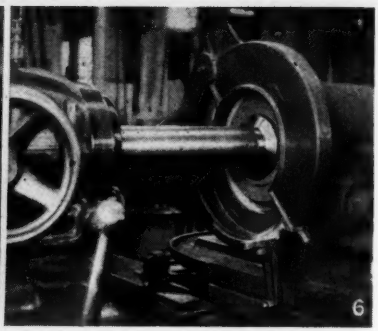


Fig. 5—Boring out an air-pump cylinder with a "Micro" grinder, using an attachment with a ¾-inch tool-bit. Fig. 6—The cylinder is finished with a grinding wheel.

is shown in use in Fig. 4. The machine consists largely of two vertical shafts, one of which carries the link, while the other is used to obtain the correct vertical adjustment. The latter is held in position by bearings at both upper and lower ends and carries the swivel from which the work-carrying shaft is suspended. The work-shaft can be clamped in the swivel at any desired height, but the final adjustment is obtained by means of a screw in the lower end of the adjusting shaft. This screw is manipulated by means of a handwheel, and has a bearing in an angle plate that is bolted to the post. By turning the screw, the shaft is raised or lowered and the finest adjustment necessary can be obtained. The grinding wheel is driven by a small motor which is attached to a shaft that extends through the post. The link is fed back and forth by hand, but a very satisfactory job can be done.

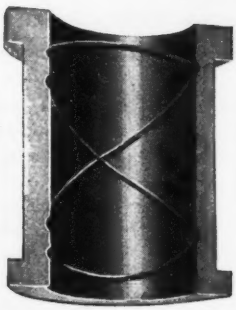
Fig. 7—An air-brake cylinder, attached to this pipe-vise, provides for savings in both time and labor.

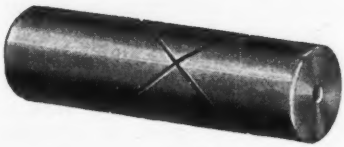
One of the finest machines ever used in any railway shop is the "Micro" grinder shown in use in Fig. 5. This machine was originally developed for internal grinding only, but the latest type, as shown in the illustration, is also equipped with a tool for boring. The boring tool is used to remove stock up to 1/32 inch, which can be removed in one cut and at a greater rate of speed and feed than is possible with the grinding wheel.

The tool-bit, which is of ¾-inch high speed steel, is held in a cap that fits over the end of the spindle-sleeve. In re-machining a piece such as the air-pump cylinder shown in process in the illustration, the hole is bored out large enough to "clean up", then the cap is removed from the sleeve and the grinding wheel is attached to the

Oil Grooves Like These

4 Per Minute





ON a CISCO UNIVERSAL LATHE GROOVING ATTACHMENT, the time required to oil groove a brass bearing 2″ long with a 2″ bore with a single figure eight oil groove is FOUR PER MINUTE. Compare this time with the old hand method of chipping oil grooves.

The attachment is readily adaptable to any standard make of engine lathe, from 14″ to 24″ inclusive. It cuts several types of figure eight oil grooves, inside or outside the bearing. It is built in three sizes of 6″, 9″ and 12″ maximum lengths of stroke. The diameter is limited only to the swing of the lathe on which the attachment is used. The depth of the groove is controlled by the operator.

Wherever installed, the attacement will pay for itself by the increase in production, and the time saved. Upon receipt of your request, we will be glad to send you bulletin and explain this attachment more in detail.

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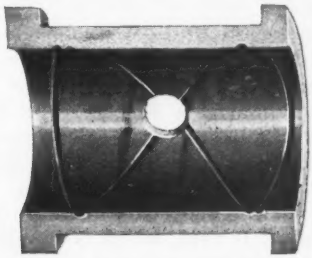
1765 Elmore Street Cincinnati, Ohio



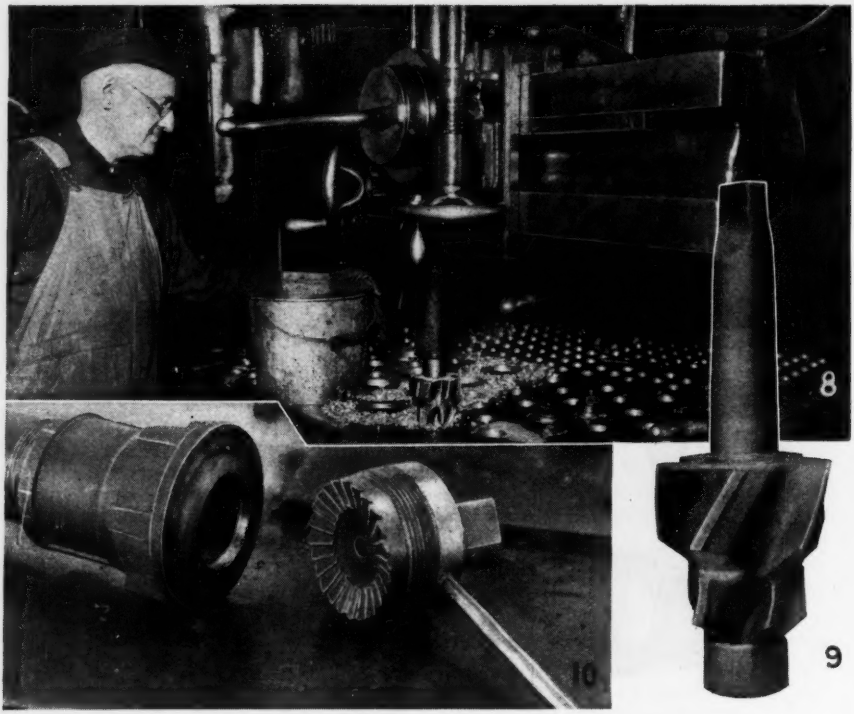


Fig. 8—Cutting superheater flue holes with a five-blade high speed steel drill. Fig. 9—The drill has been on the job five years, and is apparently good for five more. Fig. 10—This tool makes it possible to reseat feed pipe connections without removing them from the engine.

spindle. The guard is then placed in position, as shown in Fig. 6, and the grinding operation proceeds. The grinding wheel is only used for finishing, however, from .002 to .005 inch being the usual amount removed.

Among the time-saving devices that have been developed in this shop is an automatic air-operated pipe vise, shown in use in Fig. 7. The upper jaw of the vise is attached to the piston of a 12-inch air brake cylinder, which is located under the bench. The lower jaw is stationary. Air from the main line is used, which is supplied at 110 pounds pressure, but as this pressure is so strong that a pipe with a thin wall will be damaged, a reducing valve which is set for 70 pounds is used to keep the pressure down. A coil spring is set into the piston so that when the air is released, the spring will raise the piston and release the work.

The job of cutting superheater flue holes in flue-sheets, which is usually done with a trepanning tool, has been simplified in this shop by the use of a five-blade drill, shown in use in Fig. 8. The reamer, shown in Fig. 9, is made of Rex AA high speed steel, with the blades on a right hand spiral, as shown. A pilot is provided to guide the tool at the start. The blades

(Continued on page 56)

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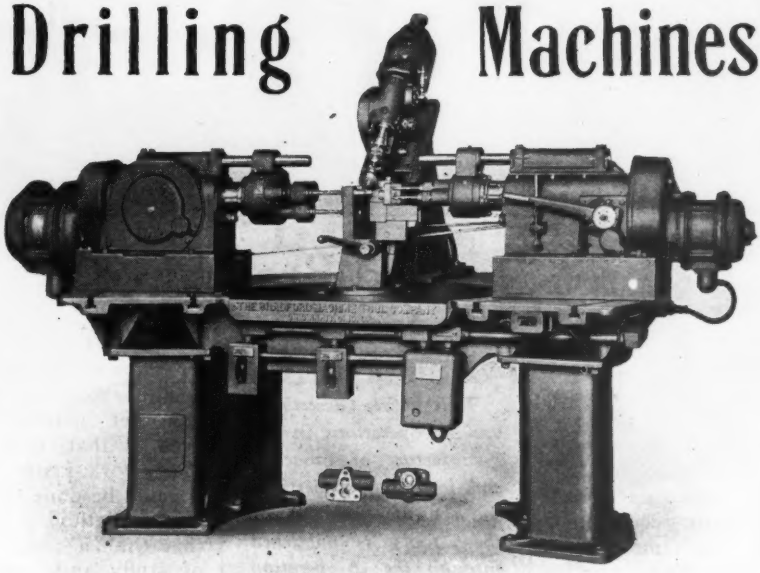

Above Three-Way Machine Drills, three 5/16"—two 33/64" and one 5/8" holes horizontally and one 7/16" hole at 40 degree angle, simultaneously in shock absorber body at the rate of 100 pieces per hour.

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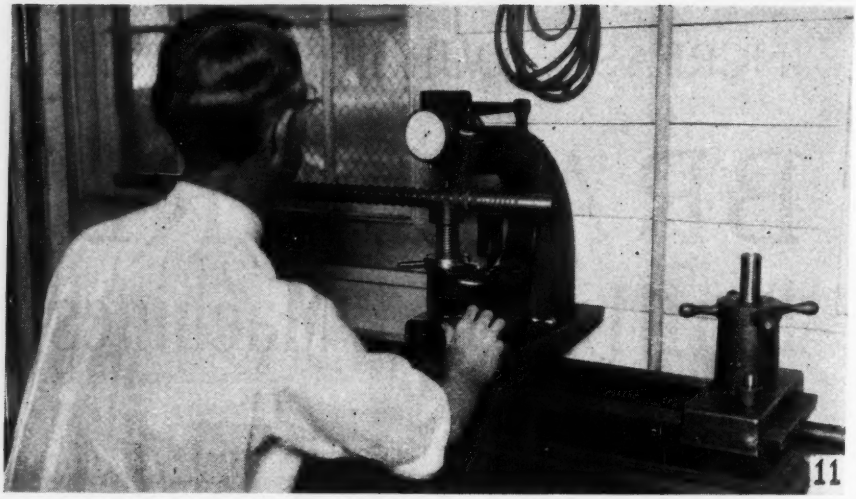


"Broaches and Broaching"

By Howard Campbell

This article, describing various operations in the manufacture of broaches, and including suggestions for the use and care of these tools, is published through the co-operation of the National Broach Company.

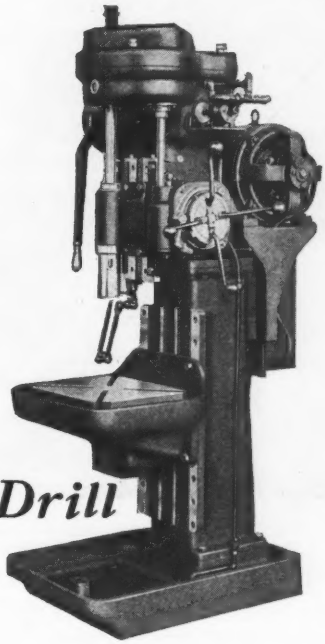
THE broach as a tool for finishing holes has been in use for many years, but the full possibilities of this tool have gone unrealized until quite recently; in fact, the mechanical executives who are familiar with the uses of the broach are still in the minority. Broaching as a production operation is coming into its own, however, and new uses to which this tool can be adapted are being found every day.

The broaches of fifteen years ago were rough-looking, rough-cutting, white-lead-smeared trouble-makers that even the foremen detested, and it was almost impossible to get a mechanic to operate a broaching machine. The usual cutting speed was somewhere in the neighborhood of three feet per minute, but even at that, they did their work faster than it could be done by any other method. Since that time a great deal of study and research has been applied to the matter of broaching, with the result that broaching has become the accepted method of finishing irregular-shaped holes, such as square or angular holes, keyways, internal grooves, and so on.

"Red Ring" broaches, the trade-marked product of the National Broach Company, are made from steels which are selected for their ability to resist wear, and because of their high tensile strength. Research and experimental work is carried on

Single Purpose Simplicity

But with
16 SPEEDS
and
16 FEEDS



The SUPER—SERVICE *Production Drill*

For high production this machine has all the flexibility of a general purpose tool, minus all complications. Gears and shafts are of heat-treated alloy steel revolving on ball bearings and automatically oiled. Built to produce faster and last longer.

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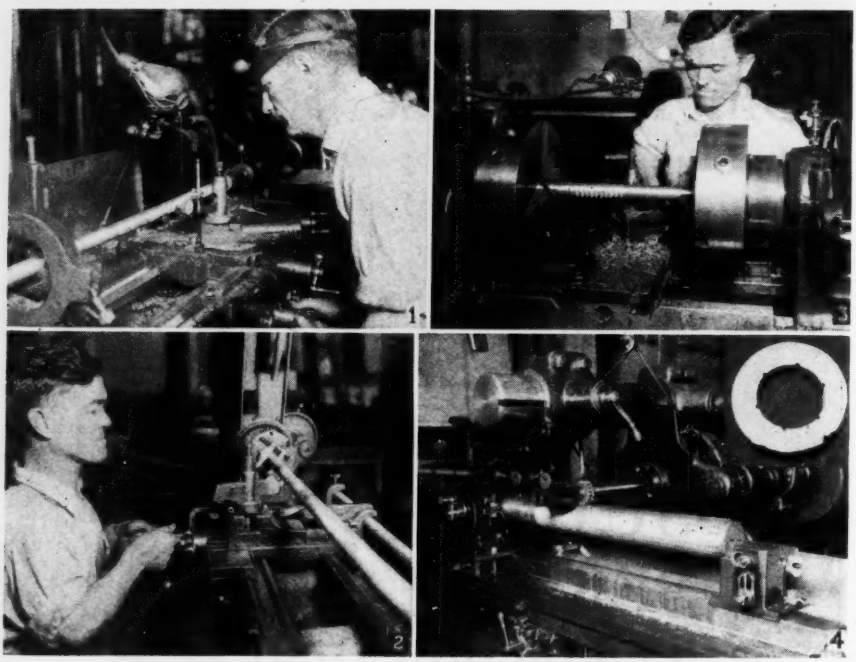

Fig. 1—Setting a tail-stock for center with the aid of a dial indicator. Fig. 2—Marking the tooth spaces on the broach. Fig. 3—Cutting the teeth on a broach. Note the chuck in the tailstock. Fig. 4—Milling the splines on a large broach. Note the piece of work in the corner of the illustration.

continuously in the search for improvement in these qualities. The stock comes in bars, which are cut to length according to the orders on file, and then are centered for the lathe. The first production operation is that of turning. The mechanic shown in Fig. 1 is using a dial indicator to obtain the correct amount that the tailstock must be set over in order to turn a taper which is required on the broach in the lathe.

After the finish-turning operation has been completed, the broach is placed between centers in the machine shown in Fig. 2 and "spaced" for the teeth. This consists of marking the broach by cutting a fine groove in it with a diamond-point tool as the piece revolves. Accurate spacing is obtained by the use of an attachment consisting of the notched bar at the rear of the lathe and a lever, attached to the carriage, which fits into any one of the notches. The lever is controlled by a foot-lever so that the movement from one notch to another can be made without loss of time. There are several of the spacing bars, each with four sets of notches, so that any required number of teeth can be spaced off.

The spacing completed, the broach is put into the lathe shown in Fig. 3 and the teeth are cut with a turning tool. The lathes used for this operation are each equipped with a special tailstock carrying a three-jaw chuck. The chuck eliminates chatter and makes it possible to obtain the per-

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REPLACE THEM WITH MONARCH HELICAL-GEARED TIMKENIZED LATHES

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Many manufacturers are solving this problem with Monarch Helical-geared, Timkenized Lathes for important accurate work—and assigning the old-timers to one or more specific jobs where great accuracy is not essential.

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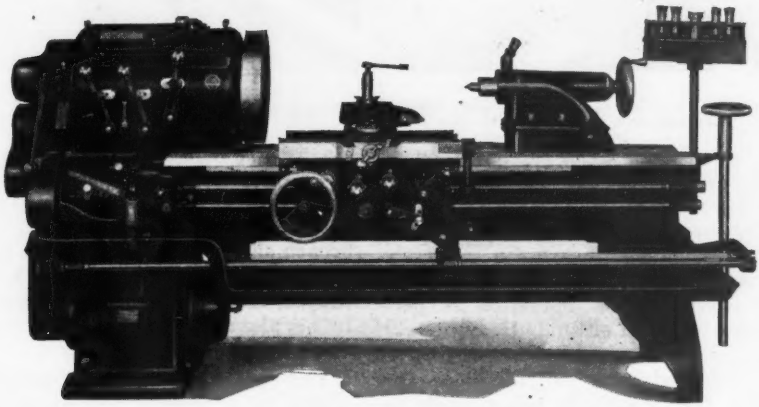

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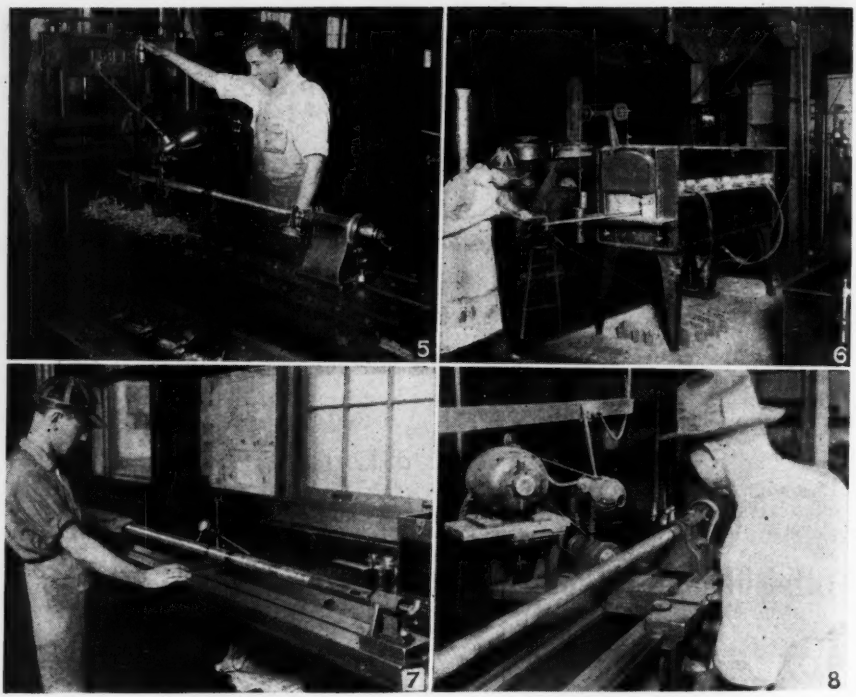
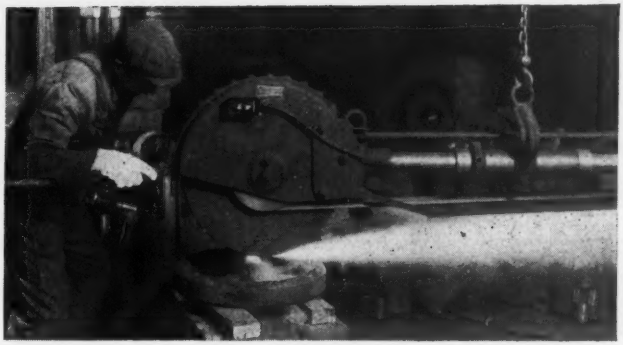


Fig. 5—Planing off the surplus metal between teeth. Fig. 6—The broaches are hardened and tempered with this equipment. Fig. 7—Inspecting and straightening the broaches. Fig. 8—Grinding the faces of the teeth.

fect job which is required on these teeth.

The next operation is that of milling the splines, or, more correctly speaking, milling the teeth to the correct width. This operation is performed on a LeBlond Heavy Duty Milling Machine, as shown in Fig. 4. An enlarged view of the piece for which the broach is being made is shown in the corner of the illustration. When each row of teeth has been cut to the desired width, the broach is swung between centers on a planer, Fig. 5, and the rest of the metal is planed off. When this broach is completed, the six grooves will be cut in the piece of work shown with a degree of accuracy and speed that cannot be equaled by any method known at the present time. The broach shown in process on the planer is a combination round and keyway broach, from which all tooth metal is to be planed except a single line of teeth down one side.

The pull slot is now machined, which is a simple operation on a P. & W. Spline Miller, and the broach is ready to be hardened and tempered. Several of them at a time are put into an electric furnace, Fig. 6, and heated to approximately 1700 degrees, then they are removed and placed in one of the gas furnaces, shown in the rear of the illustration, and heated to about



Maximum Value From Your Snagging Wheels

Maximum value can be secured from a snagging wheel only when it is exactly the wheel for the job. Different conditions demand different wheels.

Careful choice of a wheel is thus important and a few of the factors on which it is dependent are:

Kind of material to be ground
Size and shape of castings
Finish desired
Kind and condition of grinding machine
Wheel speed
Size of wheels
Personal factor

Norton Snagging Wheels are made in a variety of grains and grades. There are available two abrasives, trademarked Alundum and Crystolon. There are Norton vitrified, Bakelite and rubber bonded snagging wheels. Thus it is possible to select exactly the wheel for your job.

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W-196

2200 degrees. At this point they are removed and quenched in an oil bath. This treatment makes the steel extremely hard. Then the pieces are re-heated to approximately 1100 degrees and quenched again, which adds the quality of toughness to that of hardness. All furnaces are automatically controlled by pyrometers, thus assuring that the temperatures will remain constant and that every heat will be the same.

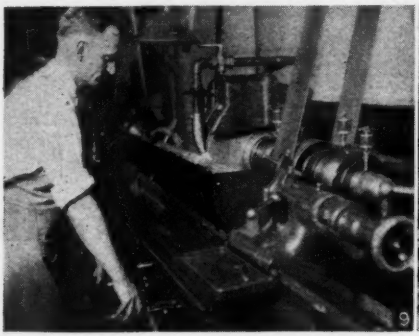

Fig. 9—Grinding the broach to size.

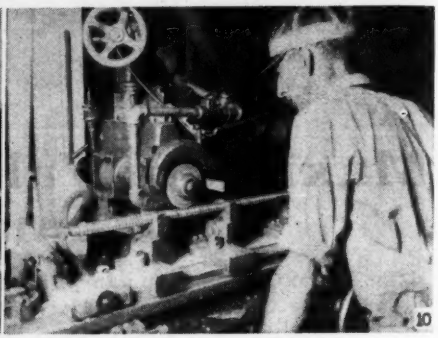

Fig. 10—Grinding the splines.

After hardening, each broach is inspected for straightness as shown in Fig. 7, and if it is bowed or curved more than .005 from the true center line, it is straightened. Then it is passed to the machine shown in Fig. 8, where the faces of the teeth are ground and the necessary "hook" is ground beneath the cutting edge. The grinding wheel is thin, and is set at the correct angle so that the right amount of hook can be obtained.

The broach now goes to the grinder shown in Fig. 9, where it is ground to the correct diameter. The last machining operation is that of grinding the splines, which is done with a ¼-inch thick wheel on the machine illustrated in Fig. 10. The broach is now inspected for accuracy and hardness, and is ready for delivery. The hardness test, shown in process in Fig. 11, at the head of this article, is made with a Rockwell testing instrument.

The long broaches shown in most of the illustrations are, of course, used in machines that pull them through the work, but a large share of the product is made for pushing through the work by means of presses of various kinds. Holes in which the amount of stock to be removed is relatively small, such as a drilled hole that is to be finished to size, can usually be handled in this manner. Bearings, which are usually made of comparatively soft metal, are finished with a broach which, in addition to the teeth, is also made with a straight, smooth end that is ground to the finish size of the bearing. The last tooth of the broach leaves a couple of thousandths for this end to "swage" to size, which it does by compressing the metal, leaving a smooth, perfect bearing.

The user of broaches will, of course, have troubles with these tools, just as he has troubles with other tools. But, if the broach is designed correctly, made of good material, hardened and ground properly, it will work. Therefore, it only remains for him to see that his operating conditions are favorable. One of the most impor-

(Continued on page 56)

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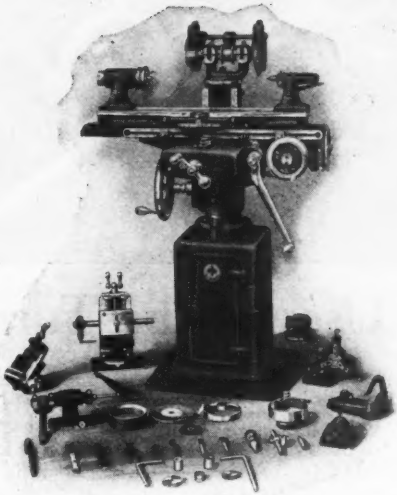

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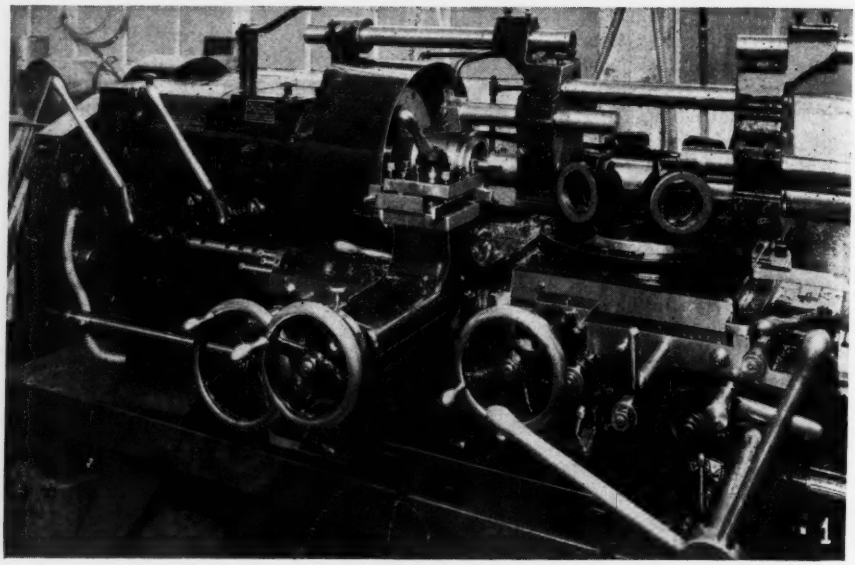

Modern Uses of the Turret Lathe

THE turret lathe is generally considered a production tool, capable of profitable employment only when large quantities are to be processed. This type of machine has its advantages on high production work, it is true, but there are many operations on which it can be employed to advantage on small lots, just as many other machines are useful on single pieces or small lots.

In order to adapt the turret lathe for use on a varied line of work on small lots, a standard equipment is required which includes two sets of tools—one for bar work and the other for parts that are to be chucked. In most cases, however, the tools can be changed on the machine in a few minutes and a lot consisting of only a few pieces can be turned out with surprising speed.

One of the most recent applications of the turret lathe is for machining cylinders for airplane motors at one of the airplane motor plants at Detroit, Mich. The cylinders are single, for a radial-type engine, and each one is an individual forging that has been rough-turned and heat-treated before coming into the shop. In the first operation the piece is finish bored, turned about three-quarters of the length, faced, and grooved. The second operation consists of finishing the rest of the piece on the outside, finish turning the end, facing, and finishing the groove, using the machine shown in Fig. 1. The piece is finished on both operations in one hour. The turning and boring operations are performed with turret tools simultaneously while the facing and grooving operations are performed by tools located in the cross-slide turret.

An overhead view of a turret lathe

(Photographs and data courtesy of The Acme Machine Tool Co.)

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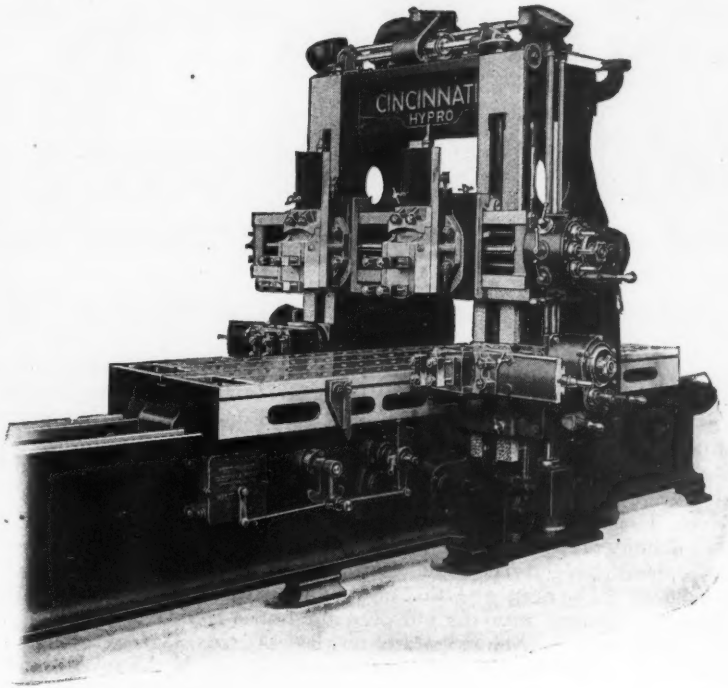

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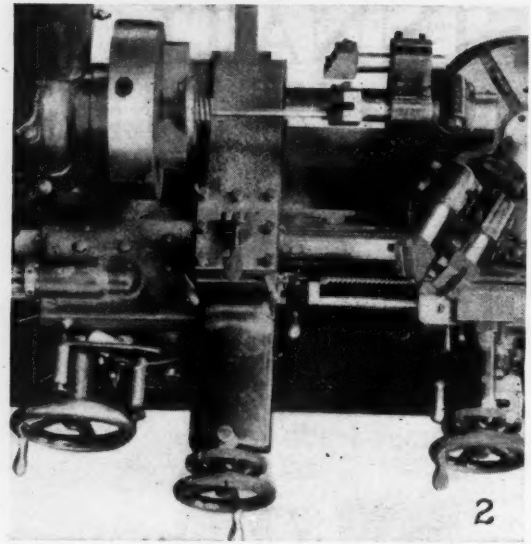


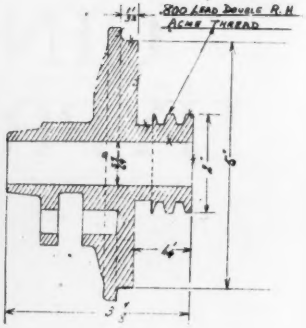
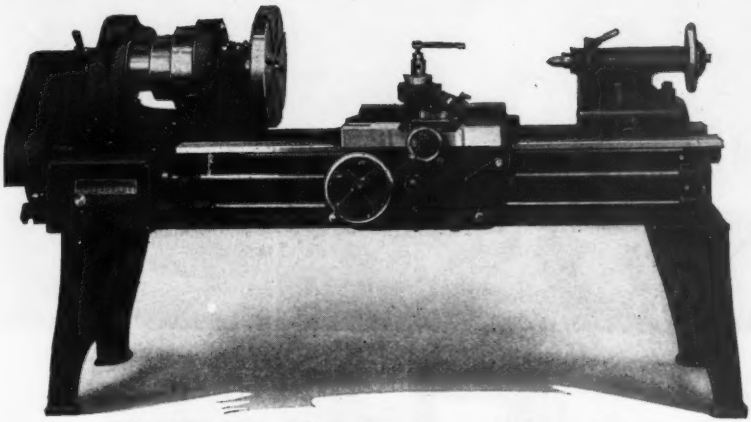


Fig. 2—Boring, facing, turning, necking, and threading a ratchet clutch. The piece is finished complete in 9 minutes. Fig. 3—Cross section drawing of the ratchet clutch.

in process of machining a ratchet clutch for use on automotive equipment is shown in Fig. 2. The clutch, a drawing of which is shown in Fig. 3, is made of malleable iron with an .800 inch double lead Acme square thread. The piece is bored, faced, and turned on two diameters with turret tools, while the cross slide turret tools are being used to face, neck and thread. The thread is chased with the aid of a lead screw type threading attachment which is a new feature on these machines. The piece is finished complete on the machine shown in nine minutes.

The use of the cross sliding turret is shown in Fig. 4, where a turret lathe is shown in process of machining 6-inch fill caps for large tanks. The illustration shows the cross slide tool in process of facing the end of the piece, while the turret tool is boring. The advantages of the machine are apparent, the ability to move the turret off center as much as is required making it possible to bore an accurate hole without the necessity of special tools. In the first operation the piece is bored, faced, chamfered and tapped. The tapping operation, for which a collapsible tap is used, is shown a Fig. 5. In the second operation the opposite end of the piece is bored, faced and chamfered, the two operations requiring nine minutes.

A turret lathe set up for machining bottle molds is shown in Fig. 6, with the two halves of one of the molds shown in the foreground of the picture. The mold shown is a two-bottle mold, and both cavities are bored out before the piece is removed from the chuck. This is made possible by the use of a special chuck which allows the piece to be shifted from one position to the other. Counterweights are provided to balance the weight of the mold when it is positioned off-center in the chuck. The form of the bottle in the mold is obtained by the use of a vertical slide in which the boring tool holder is clamped, the entire outfit being



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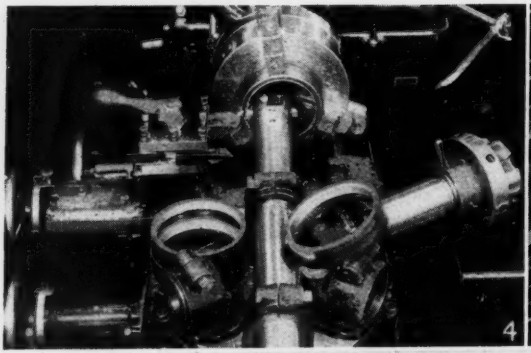

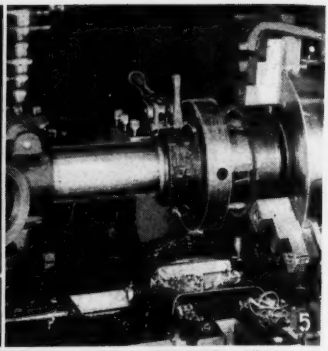

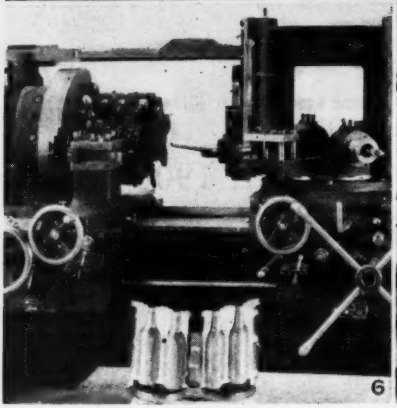

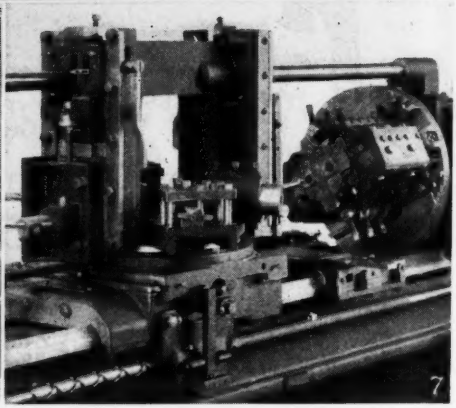

Fig. 4—The turret can be moved off center for boring. Fig. 5—Using a collapsible tap to thread fill caps. Fig. 6—Turret lathe set up to machine bottle molds. One of the molds can be seen in the foreground. Fig. 7—View showing bottle mold in machine. Two apertures are bored in the block.

mounted on the turret. The upper end of the slide carries a cam roller that rides on a formed bar, the slide, carrying the tool, being thus raised and lowered as the tool is fed into the piece, producing a cavity of the desired shape. A rear view of the machine is illustrated in Fig. 7, showing the face of the mold and also the use of the overhead pilot for obtaining rigidity.

A turret lathe set up for machining driving pulleys is shown in Fig. 8. These pieces come to the machine in small quantities, but the cost of the tools required is more than offset by the low cost of production after the equipment has been obtained. The piece is bored, crowned, turned and faced complete with the tooling shown, the crowning operation being performed with the aid of a special profile arrangement mounted on the taper attachment. The time required to machine these pulleys by the method formerly employed was 1½ hours, but with the set up shown the pulley is machined complete in 14½ minutes. This large reduction in the

(*Continued on page* 56)

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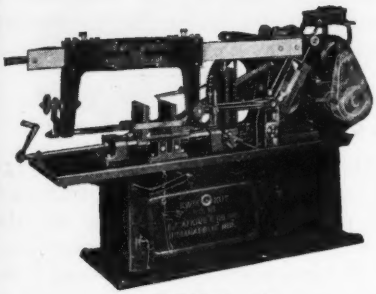

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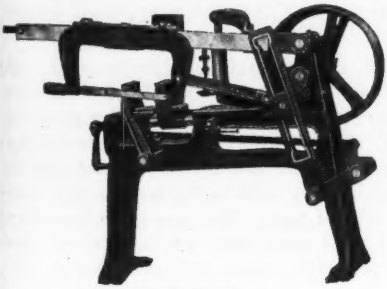

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MODERN Machine Shop

Published Monthly at
128 Opera Place, Cincinnati, Ohio
By
DON G. GARDNER - - - - *Publisher*
HOWARD CAMPBELL - - - - *Editor*

We Are Challenged!

We are in receipt of a letter from a factory production engineer, complimenting the publishers of MODERN MACHINE SHOP on the excellence of the editorial material in the first issue, but expressing the belief that we will be unable to maintain the high editorial standard that characterized our initial effort. The correspondent says: "Your Vol. 1, No. 1, was a very interesting number, but I doubt that you will be able to keep up to the editorial standard of these articles very long."

It is obviously impossible that all editorial material should be of an even standard. The subjects are purposely diversified in order that every angle of the metal-working field may come in for examination and discussion. And it is just as obviously impossible to improve the quality of the editorial matter in each succeeding issue. Methods, machines, and processes are constantly in process of change and development, and that which is new today is past history tomorrow. Consequently an article that would contain a fund of information for certain classes of our readers might be useless and uninteresting to others.

The publishers of MODERN MACHINE SHOP have set a standard of editorial quality that is intended to serve the best needs of the industry, and neither effort nor expense will be spared in making this magazine a clearing house for useful, productive ideas.

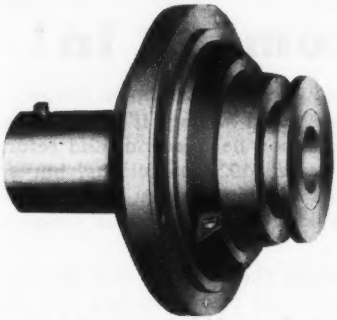
"Commencement" At Forty

Henry Ford says: "Up to the age of forty, every man is in training." In other words, according to Mr. Ford, it takes the average man until he is forty years old to graduate from that greatest of schools—the school of experience, and to become the master of his art, trade or profession. At that time he should be ready to make the best of use of his acquired knowledge.

Ford, himself, was forty years old when he founded the Ford Company. Investigation shows that the majority of the great successful undertakings recorded in history have been accomplished by men who were over forty years of age. The recognized masters of literature and art did their best work after their fortieth years.

To the young man who is convinced that, having served his apprenticeship or graduated from college, he should be made superintendent or general manager, these facts should indicate what must be accomplished before he will be ready for the top job.

And to the man of forty who has spent his years thus far in concentrating on one line of endeavor, Ford says: "Your best years are ahead of you. You are ready to graduate from the school of experience; from now on you should be applying what you have learned, rather than learning, and you should be at the 'commencement' of your best and most productive years."



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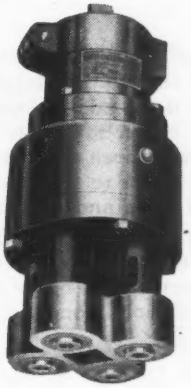

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—and they're still coming in!

ON another page last month we published the coupon shown below, and asked that if the recipient's name were spelled wrong, if the title were wrong, or if the address were incorrect, the coupon be filled out and returned to us for correction. To date we have received 192 corrections, but 1,173 coupons have been returned with expressions of appreciation, congratulating us on our effort to fill a definite need, and asking for information concerning advertised tools and machines.

These coupons are on file in our office, where they may be seen by anyone who is interested. However, for the benefit of those of our readers who might like to know what other plant executives think of MODERN MACHINE SHOP, we quote from some of the notations and letters, as follows:

"Glad to receive your publication. Fills a long-felt need. Thanks." —W. J. LOBACH, M. Mech. DuQuesne Steel Foundry Co.

"Congratulations. Fine little magazine. Some of the information was just in time. Wish you success."—J. B. MOORE, Engine House Foreman, C. & N. W. Railway Co.

"June copy received. I want to thank you. There is certainly some good information in the book."—L. RICHARDS, Shop Supt. Westinghouse Elec. & Mfg. Co.

"This hits the nail on the head. It's just the type of magazine I have been wanting."—J. J. MCNEELY, Owner McNeely's Machine & Foundry Works.

"I enjoyed this number very much and will look forward with pleasure for future issues. Thank you."—W. F. LEATHERBURY, Foreman Tool Dept., Simplex Piston Ring Co. of America

"The initial edition has been read with pleasure and filed. Viva La MODERN MACHINE SHOP*!"*—GEO. KERSCHINER, Carey Salt Co.

"Have been very much interested with articles in this issue and would certainly appreciate and thank you for keeping us on your list."—O. E. LEWIS, Gen. Mgr. General Manufacturing Co.

"A very fine book. One that will be appreciated by the vocational field."—J. A. MILLER, Director of Vocational Education.

"This is a very interesting magazine and I will appreciate receiving it every month."—R. KUNDERT, Foreman Mch. Shop, Boston Elevated Ry.

"Just the magazine I have been looking for!"—A. C. WAPPLER, Asst. Supt. Wapple Electric Co., Inc.

"Will look forward to receiving MODERN MACHINE SHOP *each month."* —W. N. NEGLE, M. M. St. Louis Coal & Iron Co.

"This magazine is excellent and meets a definite demand."—W. A. HUTCHISON, Fact. Mgr., Sharples Specialty Co.

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"I have read your first issue of MODERN MACHINE SHOP *and find it both interesting and instructive. Your magazine is well made up and indexed."*—B. E. THURSTON, Gen. Foreman, National Transit Pump Machine Company.

"This magazine is very helpful and I have read it with great pleasure."—F. J. MORISETTE, M. Mech., Chrysler Corporation.

"Your magazine received and find many interesting subjects pertaining to our work. Thank you for sending it to me."—E. J. MOORE, Supt., Western Screw Products Co.

"A dandy little magazine. Good reading and lots of information. Thanks."—J. L. BROWN, M. E., Dallas Ry. & Terminal Co.

"Glad to have MODERN MACHINE SHOP *and hope to see more of it."*—CHAS. R. PHILLIPS, Pres., Chas. R. Phillips Tool Co.

"I find the magazine very interesting and appreciate your courtesy in sending it to me."—D. W. NIELSEN, Shop Foreman, Tennessee Coal, Iron & Ry. Co.

"I desire MODERN MACHINE SHOP *to look over ads. It is so much quicker."*—T. W. ELLINGHAM, Supt., Western Harvester Co.

"I have read your June issue and think it very good, especially 'The Foremen's Club'."—W. G. YOUNG, M. M., Kindall Mills, Inc.

To say that we are extremely grateful for these expressions of appreciation would be putting it mildly, but we do want our readers to know that such expressions, coming unsolicited, are pleasing indeed. We are very glad to know that we have "hit the nail on the head" and we will continue with each succeeding issue to give our readers the best editorial material available.

Inasmuch as we are adding several thousands of names to our circulation lists this month, we are reprinting the coupon so that any error in the name, title, or address may be corrected. The reader puts himself under no obligation. We will also be glad to receive any comments, suggestions, or criticisms that our readers may wish to offer.

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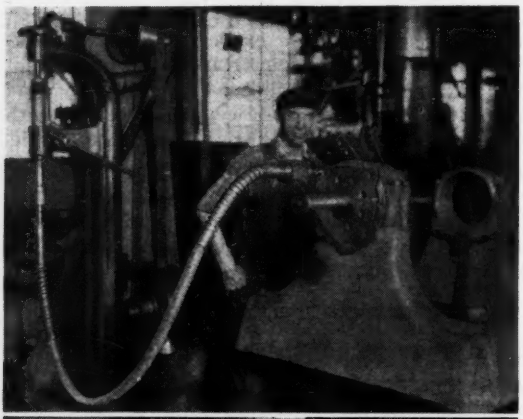
Ideas From Readers

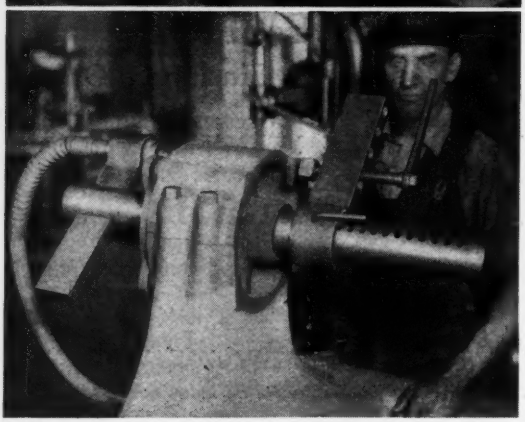
This department is a clearing-house for ideas. If there are any "kinks" or short-cuts in use in your shop, send in a description of it. We will pay $5 for each one published.

Solving a Drilling Problem

By J. H. Howell

Having an order which required the machining of several large cast iron bases for pulp mills, we found that we were up against it when we came to the operation of drilling four 5/8 tap holes (17/32 drill) in each side of each of the bearing housings. We asked for suggestions from a number of drill press and tool manufacturers, some of whom said that they did not know what to suggest, and others submitting designs for fixtures costing up to hundreds of dollars. We finally solved the problem by the use of the flexible shaft and fixture shown in the illustrations.





(Above)—Drilling a pulp mill base casting with the aid of a flexible shaft. (Below)—By turning the screw with the wrench, the shaft is pulled through and the drill is fed into the work.

The templet is bolted to a casting which is wedged in place inside the housing, this casting also serving to carry the shaft by which the drill is held in place and fed into the work. The drill fits into a ball-bearing spindle which is driven by a flexible shaft, the opposite end of which is held in the chuck of a drill press as shown. The second illustration shows how a fine-thread screw, operated by a ratchet wrench, serves to pull the shaft through the casting and thus feed the drill into the work. Nothing could beat this outfit for simplicity and flexibility, and the cost was comparatively small. One man drills the three supports on each casting in two hours.

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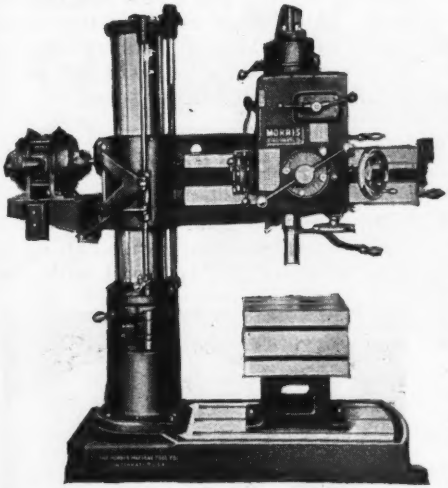

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Using Three Belts On the Countershaft

By FRANK R. HYNES

In order to make the most of the advantages that are possible with modern high speed steels, some lathe manufacturers are building lathes with fewer and wider cones in the heads to accommodate wider belts. This develops increased pulling power, but, in many cases, reduces the number of speed changes possible.

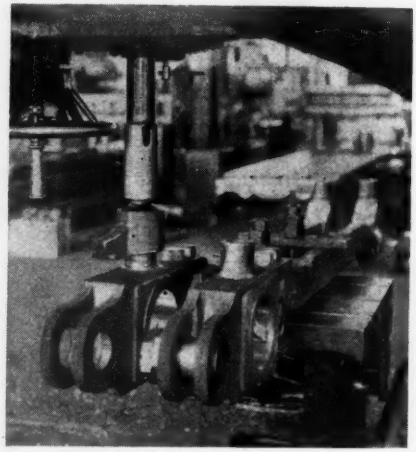
We have gone the lathe manufacturers one better by adding a third belt from the line shaft to the countershaft of each lathe, in position so that it can be used on the reverse pulley, but laced for forward operation instead of being crossed for reverse. Each reverse pulley on the lineshaft is of a size that will run the spindle at twice the forward speed, consequently the pulling power is nearly doubled by using this pulley. When we want to pull a heavy cut at a high rate of speed, we throw the reverse belt off and put on the extra forward belt. This change takes only half a minute and gives us a wider speed range, in addition to a large extra amount of power.

On a lathe where roughing and finishing tools are alternately used in a turret head, we use a slow speed for roughing and then, by throwing the shifter over, the right speed for finishing is immediately obtained. When a piece is in process of being drilled and turned, the fast speed can be used for drilling and, by throwing the shifter over, a slow speed is immediately obtained for turning. Occasionally it is necessary to take a heavy cut with the back gear in, on work that is small enough so that the fastest cone speed is used. As we do not keep our belts unduly tight, the belt may not pull the cut on this small cone. Then we shift the drive belt over a couple of cones, slowing the speed down but obtaining a larger driving surface, and throw the shifter over, which gives us about the same speed we had before. It is remarkable how much more a belt will pull with a larger cone and faster speed.

Machining Side Rod Grease Cups

By PAUL A. BARD

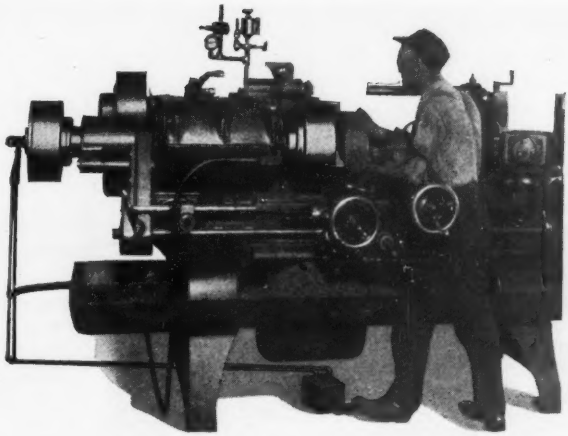
In one of the Southern Pacific Railway Shops, when a grease cup on a side or main rod is found with the



Turning grease cups on a pair of side rods

threads worn out, the cup is burnt off with the welding torch and a new one is electrically welded on. Very naturally a rough deposit of metal is formed around the cup. This metal is turned off and a smooth, nice-looking job is obtained by the use of a hollow tool holder which carries a tool bit. The tool is made with a shank that fits into the spindle of a radial drill press. The tool bit is set into the holder at the bottom so that the tool will start turning the cup before it enters the hole in the holder. By turning the cup to a size that will

LOGAN



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There is a "Logan" Air Operated Device adaptable to all types of production machines, to meet every work holding requirement; fully described in the "Logan" catalog, sent on request.

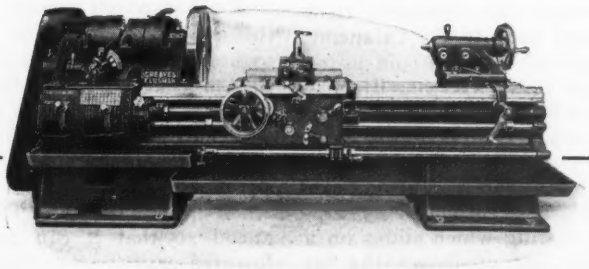
LOGANSPORT MACHINE CO., Logansport, Ind.

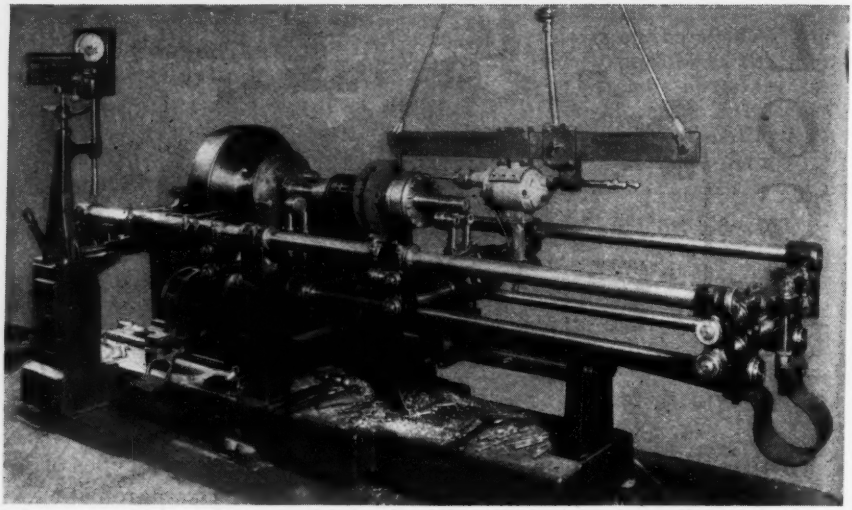
G-K NEW SINGLE LEVER CONTROL

G-K BETTERMENTS

Reinforced bed and carriage.
Spindle center back of center line of bed.
Patent tailstock clamp insures alignment.
Feed rod and lead screw supported at both ends of apron.
Double plate box form apron.
Longitudinal feed stops in both directions.
Geared quick change feeds.
Tumbler self-locking for reversing lead screw.
Steel gears in apron with cast-iron frictions bolted on.
Apron control for starting, stopping and reversing.
Hardened heat treated transmission gears.
Steel gears throughout entire lathe.

The Greaves-Klusman Tool Co., Cincinnati, Ohio





U. S. Electric Drill attached to balancing machine

be a running fit in the bore of the tool holder, the holder is made to serve as a follow-rest and a smooth job is assured. The tool is operated at a speed of 19 r.p.m., and is fed by hand.

Portable Drill Saves Time In Balancing

By H. E. LEROY

The usual method of balancing a rotor, flywheel, or other part that is intended to rotate, is to find the points of "unbalance" and then drill out the necessary amount of metal, for which a drill press is usually used. The time required to take the piece to a drill press and back to the balancing machine is a dead loss.

At the plant of the Hertner Electric Company this lost time has been eliminated by using a United States Electric Company portable 5/8-inch drill in connection with the balancing machine. The drill is attached by cap-screws to a casting which slides on a 3/8 x 4-inch flat bar, as shown, the bar also carrying a section through which a feed-screw is threaded. The latter section can be pinned at any one of a number positions as determined by the size of the piece in process. When the point of unbalance is found, the necessary amount of stock is immediately drilled out without the necessity of marking the piece and then taking it out of the machine, carrying it to a drill press, drilling, and bringing back and re-locating the piece in the balancing machine.

The feed screw is attached to the drill where the spade handle ordinarily fastens, and an "anvil" on the end of the bar which can be hooked over the end of the piece of work serves to hold the drill in position. A scale that is attached to the bar shows the depth of the hole that is being drilled. The entire outfit is suspended from overhead so that it can be swung to any position or raised out of the way when not in use, and is counter-balanced so that it can be raised and lowered easily.

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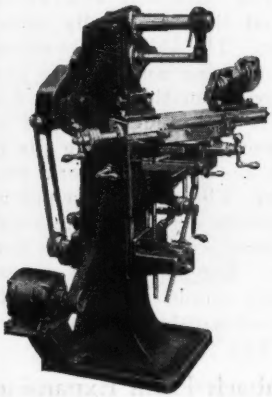
Particularly adapted to the exacting requirements of the Toolmaker, Manufacturer, Vocational Instructor and Experimenter.



A FEW SPECIFICATIONS

Power Longitudinal Feed	14"
Power Cross Feed	5"
Screw elevation of knee	11"

Table 23" x 6", swivels 45 degrees, right or left.
Spindle (No. 9 B & S Taper) has extra large bearings.
Six spindle-speeds, thru direct and back-gears.
Self-contained friction-type countershaft.
Micrometer dials on all feed-screws.

Floor-space required	50" x 36"
Net weight (Belt-driven)	650 lbs.

Can be arranged either for belt-drive, or for motor direct-connected to the nearest light-socket.

For complete details and price, write

The Artisan Manufacturing Company

879 Hathaway Street CINCINNATI, OHIO, U. S. A.

The Ball Expansion Hand Reamer

THE BALL REAMER is different from the usual type of expansion reamer in that the body of the reamer is solid, with a pilot for guiding the reamer through the hole.

THE BODY of the reamer is hardened. The blades are set in the body of the reamer and are locked at each end by set screws.

THE BLADES are made of either carbon or high speed steel. The expansion of the blades in no way affects the truth of the body of the reamer as is the case in every type of expansion reamer where the body is split. Range of expansion, .030" to .045".

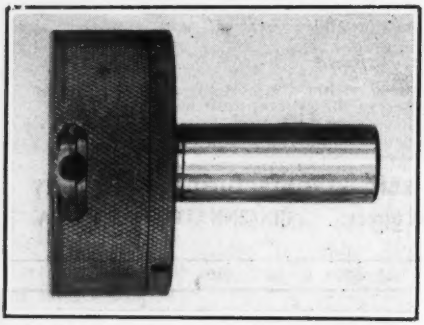
Catalogue on Request

The Schellenbach-Hunt Tool Co., 116 Opera Place, Cincinnati, O.

New Shop Equipment

Scully-Jones "B. S. Type" Floating Holder

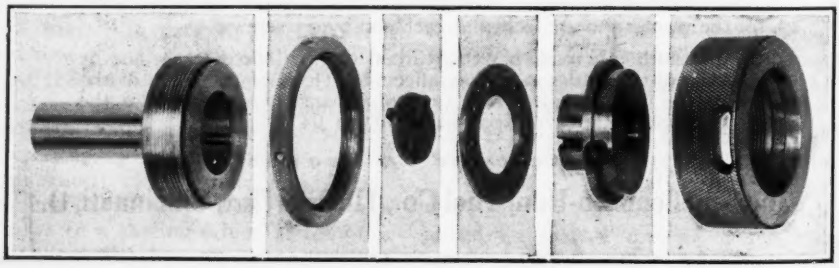
A floating holder for taps or reamers, intended for use on small automatic or hand screw machines where the clearance is limited, has been developed by Scully-Jones & Co., 1901 South Rockwell Street, Chicago, Ill. The holder is so designed that the tool can align itself properly and thus produce an accurately-finished hole. Collets, which can be quickly changed, are provided for the various sizes of tools. The feature of the holder is the ball thrust bearing, which operates between hardened and ground surfaces and thus practically eliminates friction. The collet bears against the thrust bearing and adjusts itself immediately when the machine spindle or turret tool holder is out of line with the work, thus allowing the tap or reamer to enter the work on a straight line. The couplings employed insure a positive drive for collets without interfering with the smooth floating action. Long service is assured by the high grade of material and class of workmanship employed.

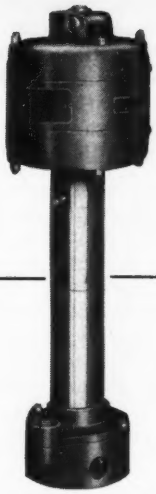


Scully-Jones "B. S. Type" Floating Holder

Schellenbach-Hunt Expansion Piston Reamer

The illustration herewith shows a reamer which has been developed by The Schellenbach-Hunt Tool Co., 116 Opera Place, Cincinnati, Ohio, especially for reaming the wrist pin holes in reamers and for similar work. The reamer is made with six Rex AA Steel blades, set on a left hand spiral of 5 degrees. The action of the blades is controlled by two collars which expand the diameter of the tool by moving the blades on a 3-degree taper. This type of construction prevents any





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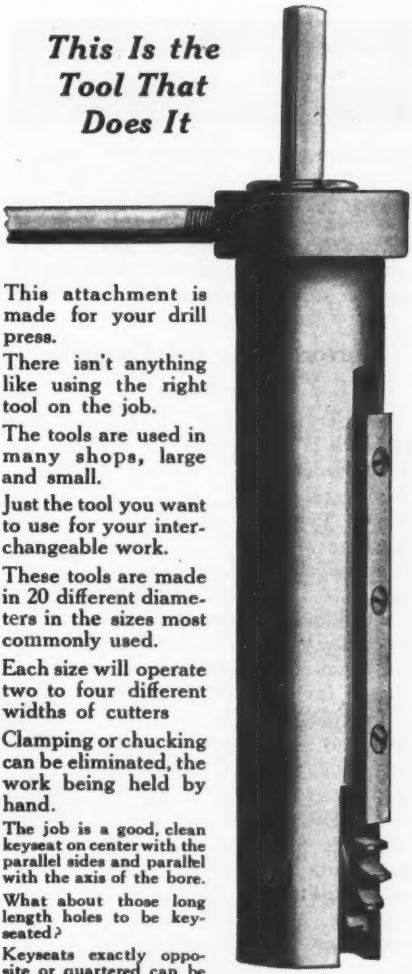
IS THE OPERATION

This Is the Tool That Does It



This attachment is made for your drill press.

There isn't anything like using the right tool on the job.

The tools are used in many shops, large and small.

Just the tool you want to use for your interchangeable work.

These tools are made in 20 different diameters in the sizes most commonly used.

Each size will operate two to four different widths of cutters

Clamping or chucking can be eliminated, the work being held by hand.

The job is a good, clean keyseat on center with the parallel sides and parallel with the axis of the bore.

What about those long length holes to be keyseated?

Keyseats exactly opposite or quartered can be milled with mathematically accuracy.

It will mill keyseats for straight or taper keys.

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NATIONAL MACHINE TOOL CO.
2271 SPRING GROVE AVE.
CINCINNATI, OHIO, U. S. A.

springing of the blades. Roller pilots on both ends of the reamer keep it in perfect alignment while it is entering and leaving the hole. The reamer is

Schellenbach-Hunt Expansion Piston Reamer

made in sizes usually required for this class of work, or from ¾ inch up. All parts are hardened and ground and the tool is guaranteed as to accuracy and workmanship.

Norton Type BA Grinding Machines

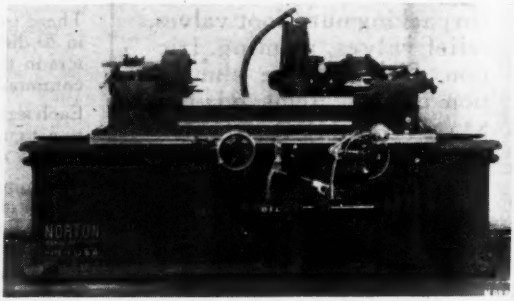
Higher production of certain types of work is made possible through the development by Norton Company, Worcester, Mass., of a new line of larger Type BA cylindrical grinding machines. The new model has a work swing of 14 inches and has been developed to meet a demand created by the efficiency of the 10-inch Type BA machine, which has been in use for several years.

The new machine has been designed primarily to grind such pieces as car axles, crankshaft bearings and similar kinds of work. Ample space is provided for work with flanges or other projections up to the full capacity of the machine, and when steady rests are necessary, pieces as large as 6½ inches may readily be ground. Standard sizes are from 14 x 36 inches to 14 x 120 inches.

All the features of the 10-inch machine are embodied in the new model, including an improved wheel spindle, ball bearing wheel feed screw, chain drive headstock, selective gear speed change mechanism, and anti-friction countershaft bearings on overhead drive arrangements. The machine may be had with all overhead or motor drive arrangement and with either power or hand table traverse.

The new wheel spindle is designed to withstand severe service and to meet the requirements of precision grinding. It is simply constructed and arranged to require the minimum amount of attention and care from the operator. The spindle is made of special heat treated alloy steel with large diameters and long bearings, and is readily adaptable to wide wheel, straight-in cuts as well as traverse grinding.

The design of the bearings permits adjustment while the machine is in operation. The lower bearing is fixed and the upper and outer are adjustable by means of thumb screws which are easily accessible to the operator.



Norton Type BA Grinding Machine

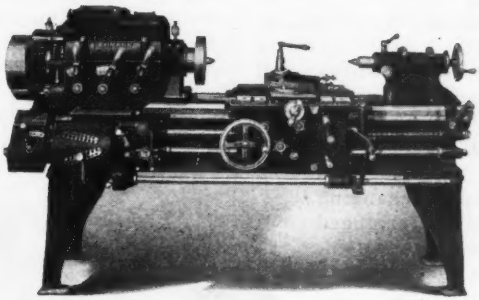
Flood lubrication, visible through glasses on front of the wheel slide, insures an ample and continuous supply of oil for the spindle.

The entire wheel slide is massive in construction with long and wide ways. The wheel is driven through a downward pull of the belt which, combined with the weight of the

"Lehmann Lathes"

TWO STYLES
Three Step Cone and 16-Speed Geared Head

5 SIZES
16/18¼"
18/20¼"
20/22"
22/24¼"
24/27⅛"



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GEM DRILL VISE

Holds Work of Any Shape

Gem Drill Vises are constructed to hold odd-shaped work. Hence, a special alloy metal of unusual gripping power; a swivel jaw, self-adjusting; V-grooves in the straight jaws. Through their ready adaptability to all types of work, Gems reduce setting-up time. Three sizes, up to 10½ inches. Circulars on request.

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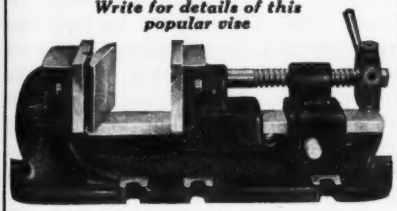

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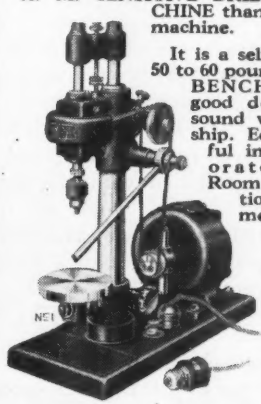
and many other vertical operations are performed more economically on the A. M. SENSITIVE DRILLING MACHINE than any other machine.



It is a self-contained 50 to 60 pound portable BENCH UNIT of good design and sound workmanship. Equally useful in the Laboratory, Tool Room or Production Department.

For its complete story ask for Booklet C.

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Fifth and Elm. S.E., Cincinnati, O.

slide itself, eliminates the possibility of lifting under the pressure of a heavy cut. Delicate feed adjustments, by means of a micrometric arrangement, advance the wheel to the work in eighths of a thousandths of an inch. This wheel feed has a large diameter screw, mounted on ball bearings and engaging a long half nut on the wheel slide. The assembly serves as a large, accurate micrometer and assures even, smooth advance of the wheel.

A convenient speed changing device on machines arranged with power table traverse encourages the use of proper speeds, reduces operating time and increases production. Speeds are changed through a selective gear speed mechanism. All changes are made at the front of the machine, and can be effected instantaneously without stopping the table, work, or wheel. An independent truing device permits truing the wheel without disturbing the lever for regular table speed changes.

The headstock may be either belt or motor driven. Power is transmitted to the drive plate without vibration or loss through a heavy silent chain provided with idler to maintain proper tension at all times. A convenient control is located on the front of the machine.

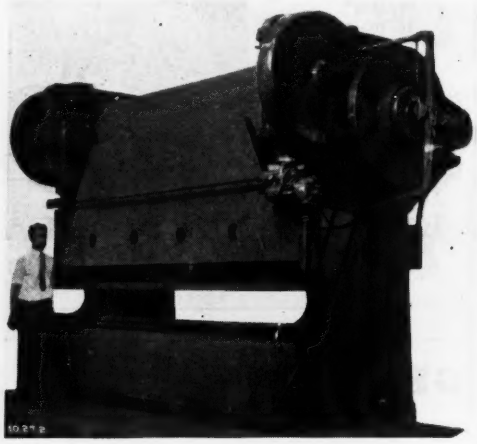
Screw or lever types of footstocks are ordinarily supplied with the machine, but for special work air or crank operated styles are available. All models are equipped with a large spindle and center.

Cast iron machine-cut spur gears can be safely run at a maximum speed of 3,500 feet per minute. For ordinary cast wheels, 1,800 feet per minute is the maximum.

120 Series Cincinnati All-Steel Press Brake

A Press Brake of new design and size was placed on the market recently by the Cincinnati Shaper Company, known as the 120 Series Cincinnati All-Steel Press Brake.

It has capacity to make right-angle bends at one stroke of the machine in ⅜-inch steel plate, 8 feet long, over a 3-inch die opening, or ¼-inch steel, 12 feet long, over a 2-inch die opening, without overload.



Cincinnati All-Steel Press Brake

While this company has been using rolled steel plate in the manufacture of their Press Brakes for a number of years, the construction of this machine is different in that the housings are made of a single plate, 4¼ inches thick, instead of double plate, box construction. The bed and ram plates are 3 inches thick. The bed extends below the floor line from 18 inches to 28 inches, depending upon the length of the machine.

Due to the method of mounting the bed and the divided connecting rod,

(*Continued on page* 59)

TWENTIETH CENTURY BALANCING TOOL

Always on the level

The most practical, sensitive and inexpensive device manufactured for balancing pulleys, cones, armatures, fly wheels, polishing wheels, etc. Will set anywhere and is easily portable. In sizes up to 24,000 pounds capacity.

Ask for the Bulletin

Sundstrand Machine Tool Co.
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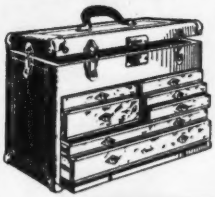
GERSTNER TOOL CHESTS



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THE RAPID DROP FORGED STEEL CLAMP

Pull the Trigger

Set the Clamp in a Second

No more time wasted turning the screw. Pull the trigger, set the ram up to the work, then give the screw two or three turns to obtain the necessary pressure,

SPEED AND RIGIDITY

Every Clamp Warranted

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The firms whose advertisements are found in this magazine are live, progressive leaders in the metal-working industry. If you need tools or equipment buy from the leaders; patronize those who are represented in these pages — and mention MODERN MACHINE SHOP. You will benefit by it.

(*Continued from page* 32)

tant items is that plenty of lubricant be supplied to the cutting edges of the tool. Lack of lubricant will cause a lot of trouble. The machine should be watched to see that it pulls steadily. An examination should be made to find out whether the back rest is in line or not. If not, either the hole will be tapered or—what is worse—the broach will be broken. If the broach pulls too hard, the work should be examined to see whether or not the hole has been properly drilled, and is according to specifications. The work bushing, pull head, and key should be inspected to make sure that they fit properly. And last, but not least, the broach should be examined to make sure that the teeth are ground correctly.

All finish teeth do not need grinding every time the broach is ground, as most of them simply ride through. Decreasing the cutting angle kills the effect of the land. The angle ground on the teeth by the manufacturer should be maintained in order to obtain the best results; he has the combined experience of hundreds of users incorporated in the design of his product, and consequently is in position to know how the best results can be obtained.

(*Continued from page* 24)

are made in "steps" of two sizes so that the tool will not have to carry too large a load at a time, and the upper, or larger, blades are ground at a greater angle than the lower ones. The lower ends of the blades are ground at approximately the same angle as the ordinary drill. The tool shown has been in use on this work five years and appears to be good for as many more.

The tool shown in Fig. 10 is one that has been developed for reseating collars on branch, feed, or overflow pipes. The cutter is attached to a shank that is a sliding fit in the body of the holder, and the holder is threaded so that it can be screwed into the union on the end of the pipe. When it is in far enough so that the cutter is tight against the seat, a wrench is applied to the square on the end of the cutter-shank and the cutter is turned, more pressure being applied as required by screwing the body of the tool into the union. As this tool is light and portable, the operation of facing a seat can be performed without removing the pipe from the engine.

(*Continued from page* 38)

time required is due largely to the use of the cross sliding turret, which is used to advantage in facing.

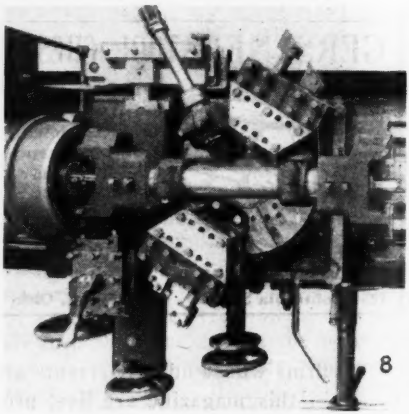

Fig. 8—Machining driving pulleys. The piece is bored, turned, faced, and crowned complete in 14½ minutes.

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JIGS — FIXTURES — SPECIAL MACHINERY

are made to meet the demand created by modern heavy-duty machinery and high-production methods. The highest quality of steel and the finest of heat-treatments are combined to make "ADVANCE" tools

dependable under all conditions

A better tool is a good investment; it will pay big dividends in increased production.

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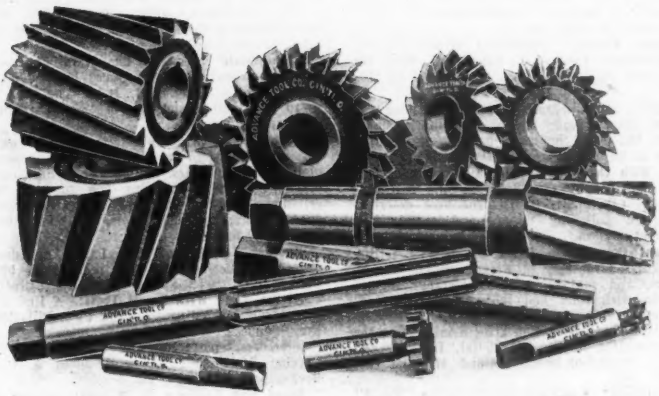
THE ADVANCE TOOL CO.

1105 Jackson Street **Cincinnati, Ohio**



For Your Catalog Library

Check any of these useful publications that you want, write your name and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Turret Lathes and Tools: Illustrated book describing Cincinnati Acme Turret Lathes and Screw Machines, and showing a variety of tools and fixtures for use with these machines. The Acme Machine Tool Co., 4955 Spring Grove Ave., Cincinnati, Ohio.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Light Manufacturing and Tool Equipment: The "Artisan" line of floor lathes, bench lathes, light universal milling machines, and combinations of shop equipment is described in a bulletin which has just been issued by The Artisan Mfg. Co., 879 Hathaway St., Cincinnati, O.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills, and horizontal drilling machines, has been issued by the W. F. & John Barnes Co., Rockford, Ill.

"The Lathe With the Longer Life" is the title of a bulletin that describes the Coneless Lathes made by the Boye & Emmes Machine Tool Co., 2247 Spring Grove Ave., Cincinnati, Ohio.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

Combination Punches, Slitting Shears and Bar-Cutters. Two new large all-steel universal combination punches, slitting shears, and bar-cutters are described and illustrated in the new bulletin No. 325, published by Buffalo Forge Company, 446 Broadway, New York.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various type and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

"The Lathe With the Pull" is the title of a catalog that has been published by the Cisco Machine Tool Co., 1765 Elmore St., Cincinnati, Ohio. The book describes the engine lathes, polishing lathes, and radial drill presses made by this firm.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock-Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Quick-Acting Clamp: A bulletin describing the "Rapid" drop-forged steel clamp manufactured by the Fountain Equipment & Mfg. Co., 2025 Elm St., Cincinnati, Ohio, has been issued by this firm.

Machinists' Tool Cases and Chests: The high grade tool cases and tool chests manufactured by H. Gerstner & Sons, 1254 Columbia St., Dayton, Ohio, are described in detail in catalog No. 27, which can be had by writing to this company.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Automatic Lathe Operation: The new Catalog No. 16, which has been published by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, describes the construction and operation of the LeBlond No. 16 Heavy Duty Automatic Lathe. A number of tooling layouts for use with this lathe are also shown.

Lehmann Lathes: Details of the outstanding features of Lehmann Lathes are given in a catalog published by the Lehmann Machine Co., 3560 Chouteau Av., St. Louis, Missouri.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Modern Lathe Design: A bulletin describing and illustrating the features of the Monarch 16-speed Helical Geared Timkenized Lathe has been published by The Monarch Machine Tool Co., Sidney, Ohio.

Roller Bearing Radial Drills: The application of Timken roller bearings in the design of modern radial drilling machines is discussed in a bulletin describing "Mor"-Speed Radial Drills, published by the Morris Machine Tool Co., Cincinnati, Ohio.

An Outline of Economical Small Drilling: The subject of small-hole drilling is discussed in a booklet that is published by Adolph Muehlmatt, Fifth and Elm Sts., S. E., Cincinnati, Ohio. The booklet also describes the outstanding features in the construction of the A. M. Sensitive Drilling Machine.

"The 'Hole' Story in One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natco" multiple drilling and tapping machines.

"Tool Room Grinding" tells how to sharpen milling cutters and how to grind drills, taps, reamers, lathe and planer tools, and dies. A number of drawings and photographs are shown, showing how to hold the tools for grinding, and the kinds of chips that should be produced by properly-ground tools, etc. Published by Norton Co., Worcester, Mass.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2943 Spring Grove Ave., Cincinnati, Ohio.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-Em-Up" drill sleeves, "Wear-Ever" chucks, collets, cutters, reamer and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1901 S. Rockwell St., Chicago, Ill.

Speed and Accuracy in Milling: Milling machine setups that turn out work with speed and accuracy are discussed in a booklet that is published by the Sundstrand Machine Tool Co., Rockford, Ill.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Brent Buys Radial Drills: A story of the methods used by a plant executive to determine what type of machine is best suited to his purpose. Published by The Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2272 Spring Grove Ave., Cincinnati, Ohio.

(*Continued from page* 10)

the reciprocating mechanism stops when the hole is ground to size. Such equipment increases the production and reduces the loss by spoilage to a minimum. Another type of machine which is designed for the same purpose is the Bryant internal grinder, Fig. 7. The design of this machine is such that when the hole is finished to size, the wheel withdraws from the work and the arm carrying the spindle swings out of the way so that the piece can be gauged and changed.

A good example of the equipment that is available for jobbing manufacturing purposes is the vertical milling machine shown in Fig. 8. The piece in the fixture is an automatic stocking unit gear box, which is being finished on one side with a 14-inch inserted-tooth cutter.

The mechanic shown in Fig. 9 is setting up a fixture casting for boring on a Lucas horizontal boring machine. The tool in the chuck is an indicator with which the hole is located centrally before the casting is bolted to the machine-table.

The building of smaller jigs and fixtures involves very close measuring and fine workmanship, consequently the locating and boring of the small holes is done on the machine illustrated in Fig. 10. This machine is a Pratt & Whitney jig-boring machine, so constructed that accurate spacing can be obtained by the use of stops and gauges. Thus the use of "buttons" is done away with and perfect accuracy is assured without loss of time.

(*Continued from page* 54)

the loads are carried directly up and down the center line of the housings. This feature practically eliminates deflection and at the same time gives greater capacity with the same factors of safety.

Other Cincinnati refinements are built into this series—automatic oiling, anti-friction bearings on high speed shafts and in the mounting of the flywheel, special disc clutch, large over-size brake drum, liberal depth of bed and ram plates, and screws of high carbon, high nickel, steel cut with buttress thread. A dove-tail slot is planed along the length of the bed, both front and back, for attaching gauges or other fixtures. A ram is raised and lowered with an independent motor drive, which is standard equipment, and included in the price.

The machines are arranged for motor drive, and the motor is connected by Tex Rope drive to the flywheel. Standard lengths furnished in this series range from 6 feet between the housings, with a die surface of 8 feet, to 12 feet 6 inches between the housings with a die surface of 14 feet.

Check the Item Wanted

If you are interested in prices or information on any of the items listed, check the item, tear out the page, write your name and address on the margin and send it to MODERN MACHINE SHOP, 128 Opera Place, Cincinnati, O. We will see that you are supplied with the information desired.

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- ☐ Abrasive Materials
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- ☐ Automatic Tapping Machines
- ☐ Babbitt Metal
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- ☐ Drills, Ratchet
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- ☐ Gauges, Plug and Ring
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- ☐ Gear Blanks, Composition
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- ☐ Gears, Cast or Cut
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- ☐ Grinding Machines, Internal
- ☐ Grinding Machines, Portable
- ☐ Grinding Wheels
- ☐ Hammers, Pneumatic
- ☐ Hobbing Machines
- ☐ Hobs, Gear
- ☐ Hoists, Chain or Electric
- ☐ Indicators, Speed or Test
- ☐ Jacks, Planer
- ☐ Keyseating Machinery
- ☐ Lathes, Engine
- ☐ Lathes, Turret
- ☐ Lathes, Automatic
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- ☐ Punches, Power
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- ☐ Saws, Band
- ☐ Saws, Milling
- ☐ Scales, Machinists'
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- ☐ Wrenches, Ratchet
- ☐ Wrenches, Tap

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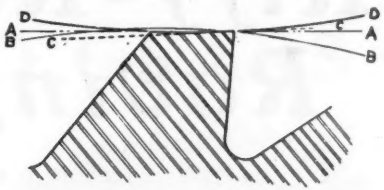
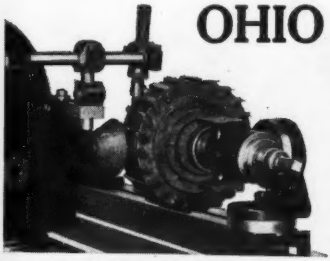
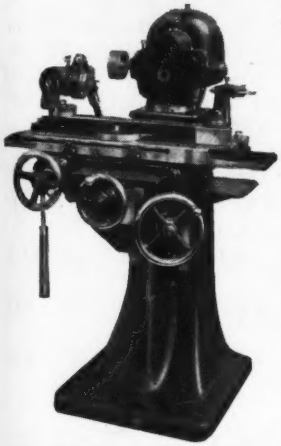
Cutting tools last longer—cut better—when properly ground



DD represents periphery of grinding wheel, BB circumference of cutter, AA desired clearance as obtained with cup wheel on Ohio Grinder, CC clearance angle obtained using periphery of grinding wheel for clearance.



Sharpening the Periphery of an Inserted Tooth Face Mill.



No. 2 Ohio Universal and Tool Grinder, Motor Driven, Forced Feed Table Lubrication.

OHIO Grinders preserve cutter life by correct grinding

MANY cutters pass their stage of usefulness prematurely due to incorrect grinding, but proper grinding costs no more than any other.

Ohio Grinders produce a solid backed cutting edge that has double the life of any hollow one.

The added life given to cutters is actually a saving in cutter investment. These small savings mount rapidly and soon pay for your machine.

It's just as easy to make your tools do more work for less cost, even though the initial investment may be a trifle more.

The sketch above shows the difference between right and wrong grinding of face mills. The illustration at the left, correct set-up on an Ohio Grinder.

You can get a complete story on tool grinding from our booklet "E." Write for your copy today.

The Oesterlein Machine Co.

3319 Colerain Ave., Cincinnati, Ohio, U. S. A.

Riff-Raff Ravings

By GEO. ALEXANDER MANN
Raver-in-Chief

OF CANS O' CORN SYRUP
PAW'S TAKEN SIX OR MORE;
HE SAYS THE STUFF'S NO GOOD,
HIS FEET ARE TWICE AS SORE—

When The Average Steno Gets Married It's Simply A Case O' Takin' A New Job With More Work An' Less Money—

Some Men Never Feel Their Oats Until They Feel Their Rye—

Half an inch, half an inch, half an inch shorter,
The skirts are the same on mother and daughter.
When the wind blows, each one of them shows
Half an inch, half an inch more than she oughter.

ONE WAY TO LOSE BUSINESS IS TO WIN ARGUMENTS—

They Say Cleveland Has The Worst Jails In The Country—Oh—Well—They Don't Have Much Use For 'Em In The Country—

The Press States: "MANY WOMEN PREACH IN THE UNITED STATES"—Yeh—An' None Of 'Em Can Wait Till Sunday—

Tha's A Hot One

"DO YOU THINK I'M DEAF AND DUMB?"
YELLED THE BOSS TO THE CHEF,
THE CHEF CHIRPED BACK "I DON'T KNOW"
"ABOUT YOUR BEIN' DEAF"—

Quiz The Folks Who Make You Tired An' You'll Find The Feelin's Mutual—

Pretty Good—Eh?

We Discovered This Sign In A Plum Street Hash Emporium The Other Day: "DON'T LEAVE YOUR WIFE BECAUSE SHE CAN'T COOK—EAT HERE AND KEEP HER FOR A PET"—

You Said Ut

"KEEP THAT SCHOOL GIRL COMPLEXION"
IS THE ADVERTISER'S PLAINT,
GOSH THA'S EASY JUST SO LONG'S
THERE'S LIP STICKS AN' RED PAINT—

Of all the sad surprises,
There's nothing to compare,
With treading in the darkness
On a step that isn't there.

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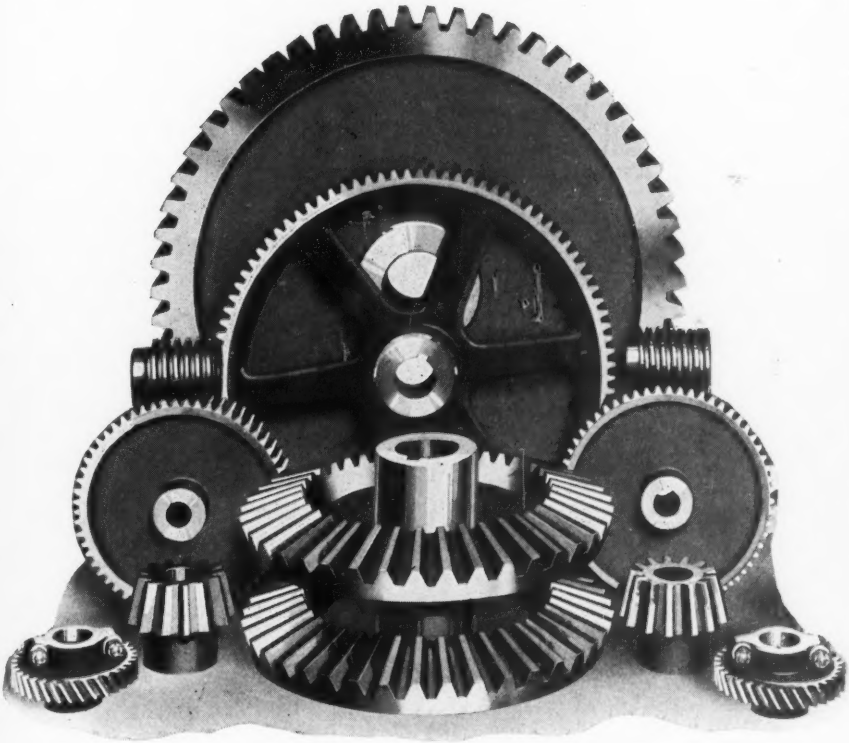
GOOD GEARS ONLY!



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U. S. 5/16-inch

High Frequency Drill

1200 R. P. M. Under Load

YOUR production will reach new high levels—and your costs drop to figures that will surprise you—when you use U. S. High Frequency Electric Tools. They operate at higher sustained speeds under all loads than tools with d. c., a. c. or universal motor. They reduce maintenance costs one-third and last longer due to their greater simplicity. They have no armature windings, no commutator, no brushes or brush rigging. There are distinct advantages found only in U. S. High Frequency Tools which will be valuable to you. It will pay you to know what these are before you buy.

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